THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

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The Incandescent Light and Decorative Art.

It was not enough for the incandescent light to have achieved the distinction of being practical. In order to supersede its rival and obtain a foothold in public buildings or private residences, it was obliged to accommodate itself to the requirements of decorative art. Although artificial lights are brought in to serve as conveniences, they are expected to play the part of ornaments. "Useful as well as ornamental" is the criterion by which they are judged, and in a great many cases the ornamental is esteemed much more desirable and important than the useful.

Gas lighting as an art has succeeded quite well in meeting the requirements of decorative art. It has learned, from long experience, to consult public wants and to adapt itself to them, and it ever seeks to gratify the sense of the beautiful by borrowing freely the suggestions of the artist's fancy or the artisan's skill.

It lends itself to the ornamentation of the grandest palaces by means of superb pendent and pedestal chandeliers in infinite variety —masterpieces of artistic design and marvels of the metal worker's art.

The incandescent light has made some progress in the same direction. Seeing as they do in the incandescent light the light of the future, those who have made an industry of manufacturing gas-fixtures naturally desire to appropriate to themselves this new field. The same artistic taste and the same skill which combined to fashion the magnificent symmetrical gas-fixture out of rich materials have contributed toward providing beautiful rich fixtures that display to better advantage the superior qualities of the incandescent light.

The intimate relation which the incandescent light can bear to decorative art even at this early period of its development was shown at the Electrical Exposition held in the Munich Crystal Palace a year ago, in connection with an exposition of decorative art. At the Paris Exposition and the London Exposition the "useful" side of the incandescent light had been fully exhibited, and Munich was just the place where its "ornamental" side could be brought into relief. Nowhere do the decorative arts prosper and flourish more than in Munich, the Florence of Germany, and a harbor of refuge for painters and sculptors without number. With its museums full of the best paintings, the best works of art of all description, it offers the most valuable suggestions to the artist and affords the most beautiful models to the artisan. Under circumstances so favorable, it was not too much to expect, then, that such an excellent theme for decorative effort as the incandescent light would lead to an interesting display, and, in truth, the chandeliers and fixtures adapted to the incandescent light constituted one of the most interesting features of the exposition. These exhibits were all the more interesting from the fact that they came in nearly every instance from makers of objects intended for interior ornamentation and decoration rather than from electric lighting concerns. In a word, they represented a specialty of manufacture, and testified alike to the readiness with which an industry of this kind can adapt itself to a new place and to the excellence of its work.

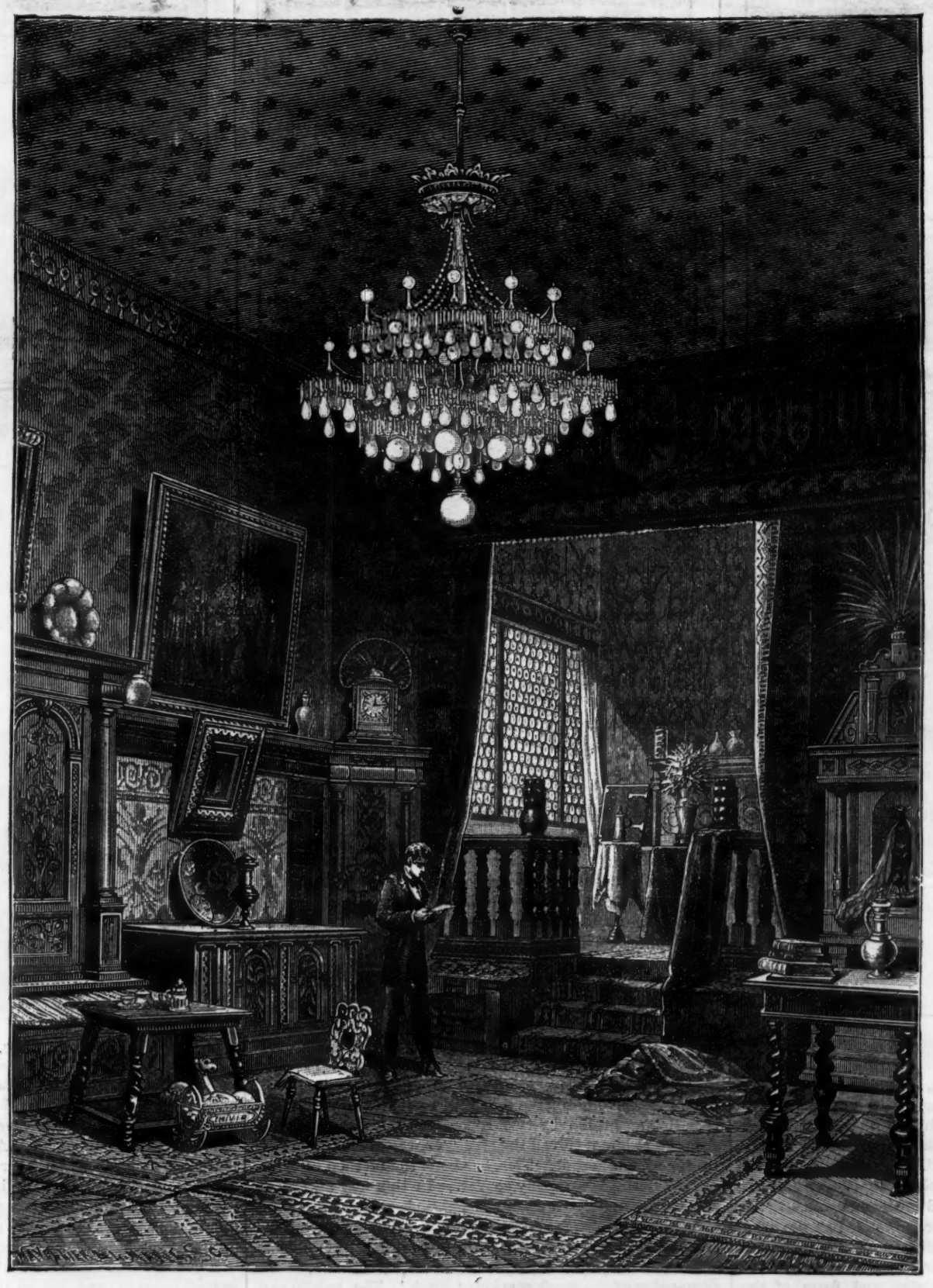

FIG. 1—AN ART-ROOM LIGHTED BY A CHANDELIER OF INCANDESCENT LIGHTS.

We reproduce from our esteemed contemporary, *La Lumière Electrique*, some excellent illustrations of a few of the chandeliers which attracted special attention at the Munich Exposition. Our front page illustration represents one of the elegant art-rooms of the exposition lighted by a magnificent chandelier of incandescent lights. The design was very unique, the arrangement of the lamps in combination with rows and circles of prismatic refractors being such as to present a beautiful appearance, while the light emitted produced the most diffused and satisfactory illumination. This marvel of decorative art was exhibited by a Berlin house whose fame for artistic bronzes is well established.

Fig. 2 shows a pendent side-bracket fixture of bronze for four lights, with opaline shades suggesting an opening flower, and which was much admired on account of its richness and its neatness of design. It was exhibited by another celebrated Berlin house. A chandelier which excited a strong admiration is shown in Fig. 3. It was made entirely of wrought iron, and of complex design, evincing most skillful workmanship. The upper portion was embellished by glass flowers of variegated form, which relieved the beautiful turns and ornaments, while the lamps were all placed at the lower portion in a position most favorable for projecting their light downward. The chandelier shown in Fig. 4 is also an interesting specimen of the same kind of work, and in which the lights are agreeably disposed in a circle by distinct branches radiating from a central pendant. This chandelier seems to be relieved of the cumbrousness which strikes the eye as objectionable in many chandeliers for gas as well as for the electric light.

Fig. 5 represents a three light side-bracket which also attracted much attention, not so much on account of its elegance as on account of the bold originality of its form. It was exhibited by an English house.

Besides these there were innumerable other equally fine

specimens which it seems almost unfair to neglect in this connection. The review of all these different styles, each possessed of its own characteristic merits, could be made to embrace several pages. The incandescent light was blended with decorative art in every conceivable manner and for every imaginable purpose, the variety of bronze pedestals of all kinds and shape being surprising.

These manifold combinations serve to show how great are the resources which the incandescent light places at the command of the artist. With gas a certain formality, or we may say conventionality of design, must be preserved, because the conditions of its use impose certain limitations. For instance, the jets of gas must be turned upward to burn steadily to produce light to advantage. Again, it is not expedient te bring gas lights too near the walls and ceilings, because the smoke and soot of the flame deface and tarnish them. With the incandescent light the designer is not limited by such considerations. These lights burn equally well in all positions, and they give off but little heat, and, of course, are free from smoke and vapors that soil the surrounding decorations. Besides, while the design of a gas-fixture necessarily presents a certain monotony from the fact that the size of the jet cannot be varied sufficiently to permit of varied effects, the incandescent lights may be of any size or shape desired. The chandelier shown on our front page illustration is an interesting example of this variation.

As a good illustration of the adaptability of the incandescent light to decorative effect, we will refer briefly to an application to church lighting in a small chapel especially adapted for such exhibits, that was deemed possessed of so much artistic merit as to be honored with a great prize. It was a statue of the Virgin and Child surrounded by a large oblong wreath or garland of flowers and leaves made of wrought metal. At the centre of each flower was an incandescent light, the design being remarkably beautiful and the effect grand in the extreme.

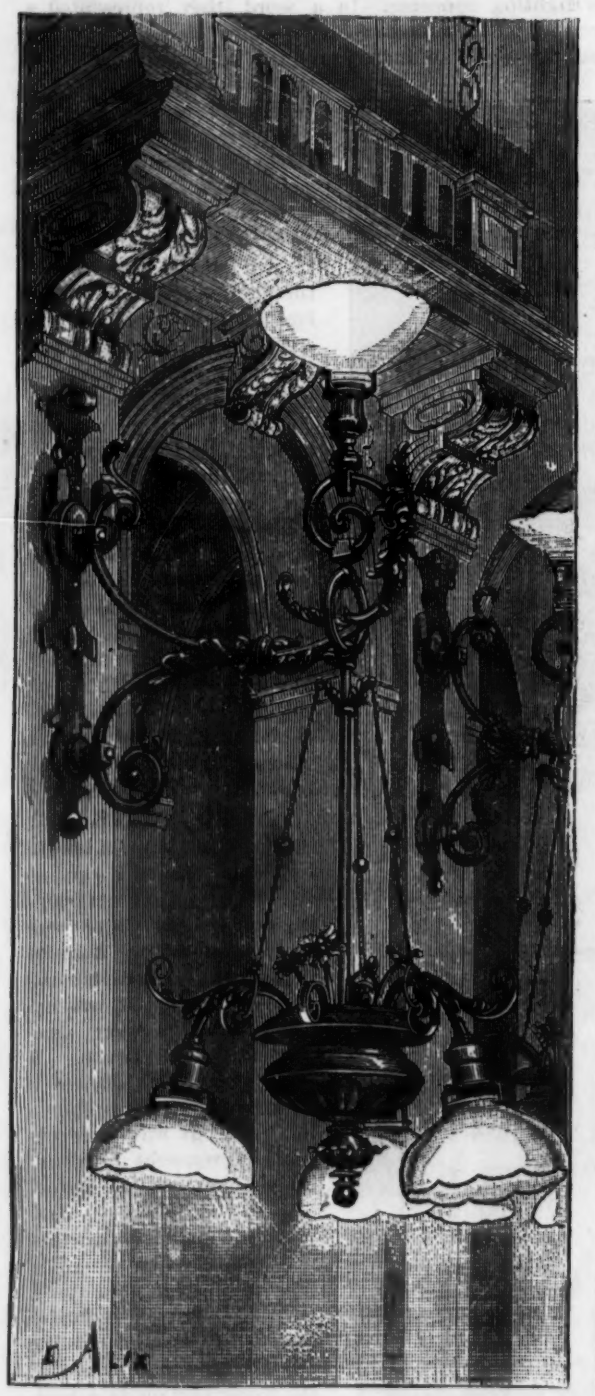

FIG. 2.

As an instance of the useful combined with the ornamental we must refer to the application of the incandescent light to street lighting, which was a feature of the Exposition. Fig. 6 shows the design and form of the lamps and lamp-posts used in this novel installation, probably the first instance of street lighting by the incandescent light. Without stopping to consider the economic questions involved or to make comparisons with the arc light as used for street lighting purposes, we will only state that the credit of this originality was due to the Edison Company, whose system was the one used. Each street light consisted of three incandescent lamps inclosed in a glass globe, and a reflector disposed above them served to diffuse the light equally in all directions.

In all this grand display at the Munich exposition, the absence of the products of American trade and skill was indeed to be regretted. It must not be believed, however, that because we lack the advantages which Europe possesses in having able artists and skilled artisans in large numbers, we are unable to use the incandescent light to good advantage for producing tasty and brilliant effects. We propose to return to the charge on a future occasion, in order to make public the excellent merits and beauties of our domestic products in this line.

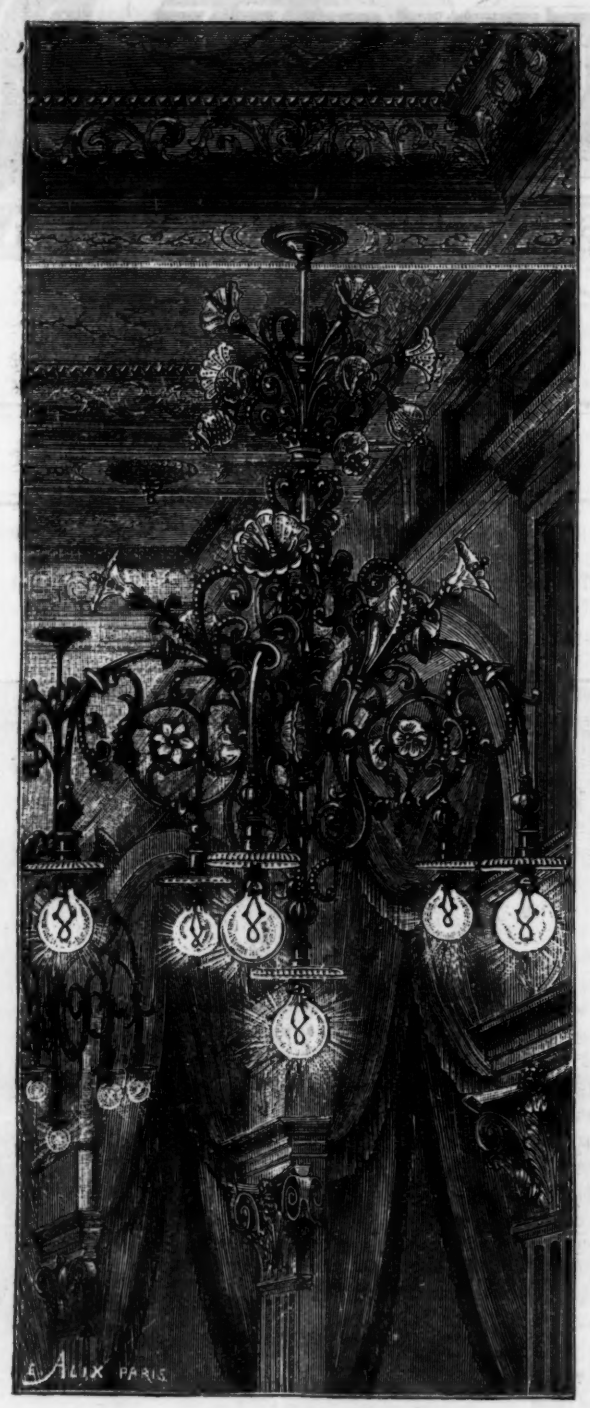

FIG. 3.

Criticising the Lowell Syndicate.

The Boston *Herald* of September 5 published a severe onslaught against the Lowell Syndicate. An anxious stockholder from Lowell was seen in Boston, the *Herald* said, and questioned in regard to his position and opinion in the matter. This gentleman, among other things, said: "The plan of the original pool has been to buy at a certain price, or rather to form a company at a certain price; then they immediately turned about and sold to another pool at from 25 to 50 per cent. in advance of what they paid, at the same time binding the pool, or to whom they sold, to sell the stock at so many dollars a share above what they, the second pool, had paid for the shares. This, of course, insured the second pool a profit, and made the offer of the first pool more tempting. Thus two distinct profits by two separate pools were made before the public received the stock or was given the opportunity to purchase it. This has been the method of forming every single company so far. In this way all risk is, and has been, thrown upon the public." * * *

* * * "Now, the question which interests the public is that the people who bought the stocks of the syndicate of the second pool are unable to sell them, and are, in the vernacular of the stock market, 'stuck.' The public can not get rid of its stock to-day at a profit, nor was it able to before the recent failure of the contemplated consolidation schemes and upsetting of the market. All the telephone companies have paid thus far good dividends, but the methods which have been used to bring about the payments of such dividends, rather the means to pay them, should be a subject of public inquiry."

The Lowell *Citizen* presents the matter from the point of view of the syndicate, and publishes a long article to refute the charges, in which it says: "In the case of all the New England companies under Lowell management, the stocks were put out at cost, the syndicate benefiting only by the rise on their large holdings. Not until they went out to the land of Dakotahs and gathered in the Northwestern, did they advance the price to the public above what they paid themselves. They did the same with Southwestern and Erie, which they had a perfect right to do, and the steadiness of the consolidated Erie stock throughout the low stage of the market shows a confidence on the part of the stockholders, whom our 'anxious stockholder' certainly does not represent. As to the payment of dividends, which he says should be 'a subject of public inquiry,' there can be no doubt in the minds of those who know the Lowell managers that dividends are paid out of actual earnings, and that those earnings are increasing from month to month. In short, the cry of this anonymous individual sounds very much as if he had been left behind somewhere and was trying to get up with the rest of the party."

The Lowell *Courier*, in an editorial on the same subject, gives the following account of what the Lowell syndicate has done:

"They bought first, early in 1882, the National Bell Telephone Company of Maine, paying $110 a share for every share of the stock, and selling it at the same price to anybody and everybody who would purchase, and it did not meet with a very ready market either. But under the syndicate management the Maine has paid 15 per cent. on its cost (110), and the stock went up in open market to an extreme limit of about 280. A stock dividend was recently made on the basis of an average value of 240—or three shares at 80, at about which figure it is now quoted, paying 5 per cent. dividend on a par of $100.

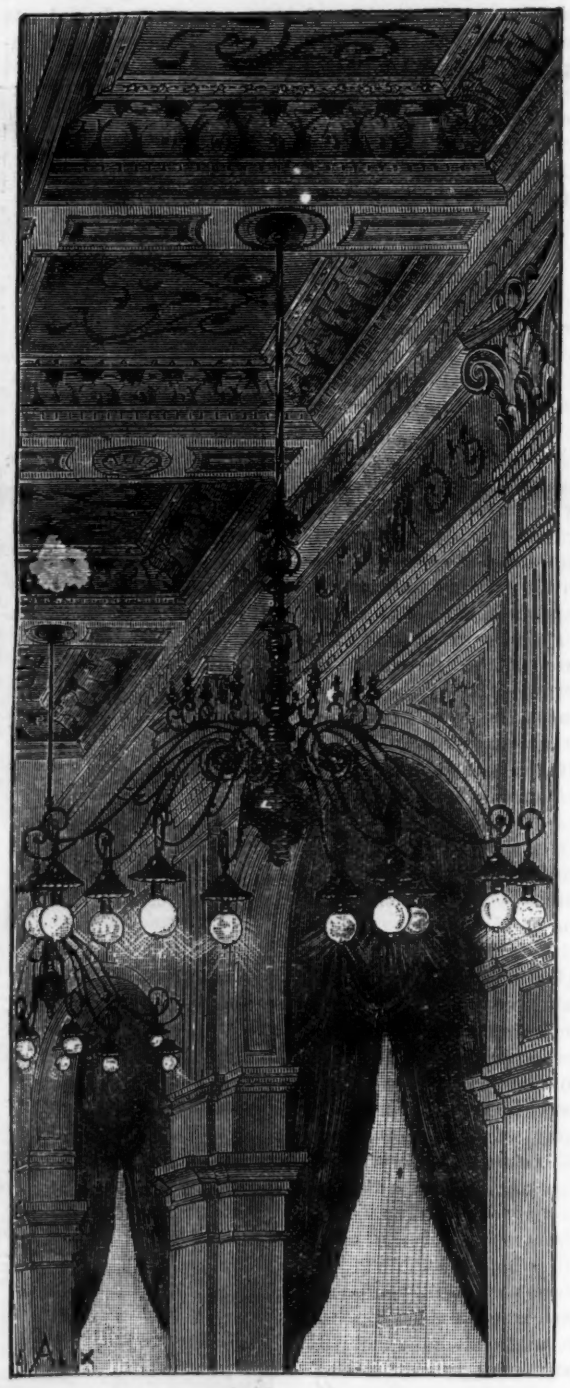

FIG. 4.

"In May, 1882, the Boston and Northern was purchased by the syndicate at $90 a share, and everybody who wanted it could be supplied at that price. Lowell capitalists were begged to go in, and did so timidly and cautiously. The syndicate made its money by boldly taking 2,000 shares of the stock, which, as it earned an average dividend of 10 per cent., with certain other advantages as to taking new stock, carried the price quickly up to 165.

"The Suburban came next in August the same year, for

which the syndicate paid $75 a share. This earned and paid an average dividend of 8 per cent., on a par of $100, and the stock, of course, went up, and those who had sagacity and courage to buy, made a good thing of it.

"The Bay State was the last of the distinctively syndicate purchases in New England, and it was the poorest purchase of all. It was bought at a higher price than the others, and because it surrounded certain other territory owned by the syndicate, and was needed to render convenient the operation of the exchanges surrounded by it. The syndicate paid $116 a share, and it is the only syndicate stock now selling at a figure lower than the price at which it was bought. But it pays fully 7 per cent. per annum on its par value.

" We have not at hand the figures at which these stocks have sold, but it is certain that every one of them to-day, with all the disturbance created by the proposed consolidation, in the midst of almost a general panic in the stock market, and with all the scarecrows raised about the telephone patents, is selling at a handsome advance over the price at which they were openly offered to all the world. Every one of them, too, is actually earning and paying a

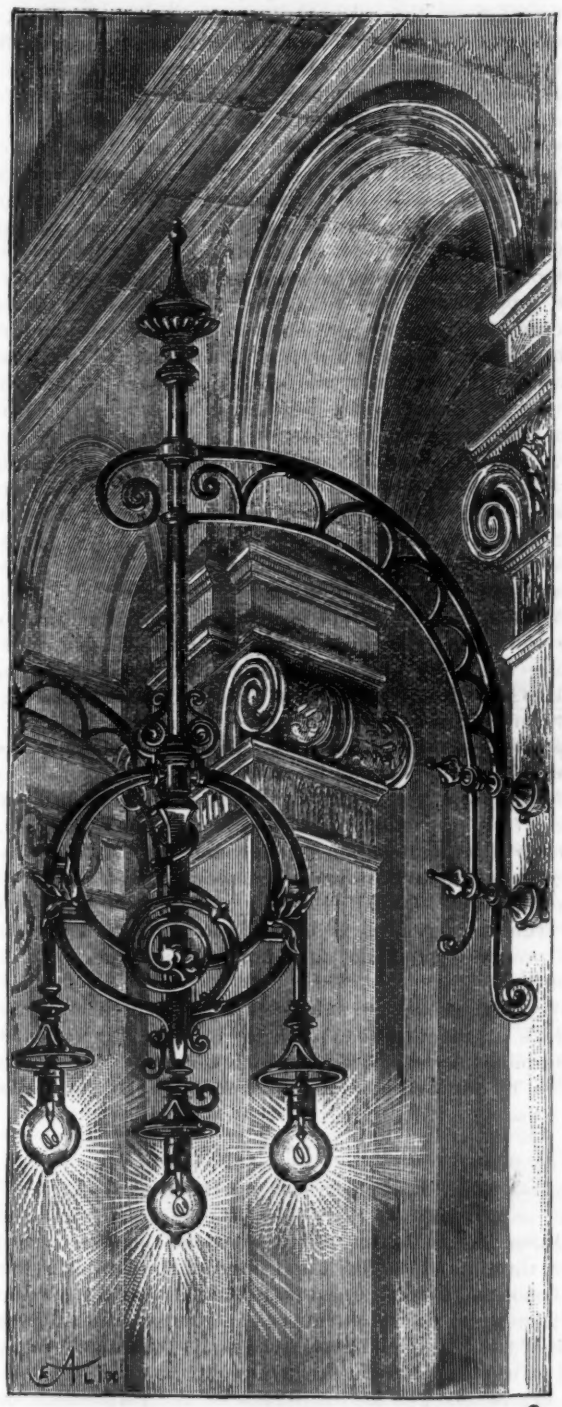

FIG. 5.

handsome percentage of dividend on the prices at which they were quoted. It is this dividend earning and paying which, as we have remarked, keeps the stocks fairly above water in the midst of a very deluge of depreciation.

' And this is all there is to the mystery of the Lowell syndicate, relative to the New England companies."

Lighting Ford's Opera-House, Baltimore.

One of the most recent installations of the Edison Electric Lighting Company is in Ford's Opera-House, Baltimore. The following description of the plant is given by the Baltimore *Sun:*

The engine and electric generating machinery of Ford's Opera-House are directly under the vestibule. The steam boiler has capacity to run a 65 horse-power engine. It was built by the Babcock & Wilcox Company, New York. The Lawrence engine, stationed near the boiler, is of the Armington & Sims make, Providence, R. I. The engine is 40 horse-power. The dynamo used for generating the current occupies a position in the engine-room also. It is the Edison patent, type H, or 400 lights of 16 candles each. It has an automatic regulator, which, in case any number of lamps are turned off, adjusts the current so as to keep the candle-power uniform. The dynamo is of the latest improved pattern, and is finely finished, being trimmed in polished brass work. It has three pairs of huge magnets, with columns about six feet high, the whole being mounted on an iron base three by six feet. The armature revolves between the poles of the magnets at the rate of eleven hundred revolutions per minute. On one end of the armature is the commutator, on which the brushes rest. These carry the current through a pair of polished brass rods to the mains, which distribute it throughout the building. The dynamo is similar in size and finish to those in use at the *Sun* office.

There are two switch-boards, one of which is located in the ticket office of the Opera-House and the other on the stage. The one in the ticket office governs all the lights in the lobbies and two clusters outside under the portico. For each of the large chandeliers and clusters of lights there is a separate switch and safety cut-out, so that the whole can be controlled by a person in the office. In the vestibule is a magnificent newel, made of highly-polished brass, with an imported porcelain vase. There are four lights on the newel, with handsomely colored shades. In the centre of the vestibule are two chandeliers, with six lights each, and a large crystal chandelier having 23 lights. There are two chandeliers of 10 lights each outside under the portico, which have under-reflectors, giving a very brilliant light. In the lobby, which is between the vestibule and main auditorium, there are four brackets, two of three candles and two of two candles each. In the drawing-room, which is immediately above the vestibule, there are two four and two six-light electroliers, all finished like the other fixtures, in polished brass.

The switch-board located on the stage controls all the lights in the auditorium and on the stage through the medium of two large regulators by simply turning the handles. The lights are divided into circuits, so that they can be reduced to any extent required when it is designed to darken the house, even down to two lights if necessary. There is also a safety-switch and cut-off for each circuit in the auditorium and stage, and each circuit can be cut off entirely as well as regulated to any degree of intensity.

The proscenium lights consist of four polished brass fixtures fastened over the boxes, each having five lights. The stage is lighted by 60 footlights, each having 16 candle-power, producing a splendid effect. There are also four borders over the stage, 26 lights each, and four sets of portable bunch lights, of eight each. The dressing-room passageways have two-light brackets. The main auditorium is lighted with brackets, twelve brackets each with three lights extending from each circle, and six side lights attached to the wall below the dress circle. In the upper tier or gallery are two pendants of polished bass, with three-light electroliers. The boxes are each supplied with a bracket lamp, which can be turned on or off by the occupants at their pleasure. The entire building is therefore lighted by electricity, doing away with the necessity of gas, which, on account of its heating qualities, is objectionable for lighting theatres, halls, etc.

An Improved Long-Distance Telephone.

Mr. Webster Gillett of Flushing, L. I., thus described his telephone to a reporter of the Cincinnati *Commercial Gazette*: "That funnel-shaped object in the centre of the disc is the resonator. You see that it is not like the speaking tube of an ordinary telephone. The larger part of the funnel is held to the mouth. The volume of the voice, instead of being concentrated in a small space, as in other telephones, is spread over, and causes the whole metallic diaphragm to vibrate. You will notice on the opposite side of the disc there are ten deviating points, which are held in position by ten rubber arms, that may remind you somewhat of a cuttlefish. When you talk through the speaking tube or resonator, the metallic diaphragm, or popularly speaking, the tin plate, vibrates. The vibrations are communicated to the ten deviating points or needles. The needles penetrate through rubber cushions into small brass cylinders containing granulated carbon, The cylinders are secured in their places by ten brass arms attached to the rim of the disc that holds the metallic plate. Ten wires run through the arms from the primaries of the induction coils and return to their respective poles. The ten secondary wires from the induction coils are carried to a plug-switch, so arranged as to place one or as many wires as may be desired in circuit. The power of ten batteries, ten induction coils and a corresponding number of deviating points, acted upon simultaneously by a single vibrating tin plate, may thus be concentrated upon a single wire. This is something that has never been done before. I claim that conversation may be carried on over an ordinary telegraph wire, with my telephone, between points 2,600 miles apart. Twelve words a minute is considered a fair rate of transmission over the Atlantic cable. By using the telephone, 120 words a minute may be transmitted, if a short-hand writer is employed as a receiver. All the important features of my invention are new. By the use of the granulated carbon and the rubber cushions, into which the needles penetrate, I secure a steady, uninterruptable sound."

Milwaukee Aroused.

Milwaukee would seem to be a good place for an enterprising opposition telegraph company to establish an office if we may judge by the following wail which we extract from the *Sentinel* of Aug. 22: "In Milwaukee, a city of 150,000 inhabitants, business on 'Change stopped yesterday. So at St. Paul and Minneapolis, cities of 60,000 to 100,000 inhabitants. No communication with the business centres in the East was possible to the millions of people in Wisconsin, Minnesota, Iowa, Dakota, Nebraska and other Western States and territories. A trivial every-day kind of accident happened to the top floor of a Chicago building, and at once all business depending on the telegraph came to a dead stop in the great Northwest. A fire in Chicago—a city of fires—is able to disturb the business and convenience of millions of the busiest people in the whole country. When a Chicago telegraph operator cuts his finger or gets on a spree, the readers of the daily papers in the Northwest have the number of their news dispatches reduced, and they learn of important events only when the Chicago operator's finger has got well or he has sobered up. If the great Northwest will sit down and think for a

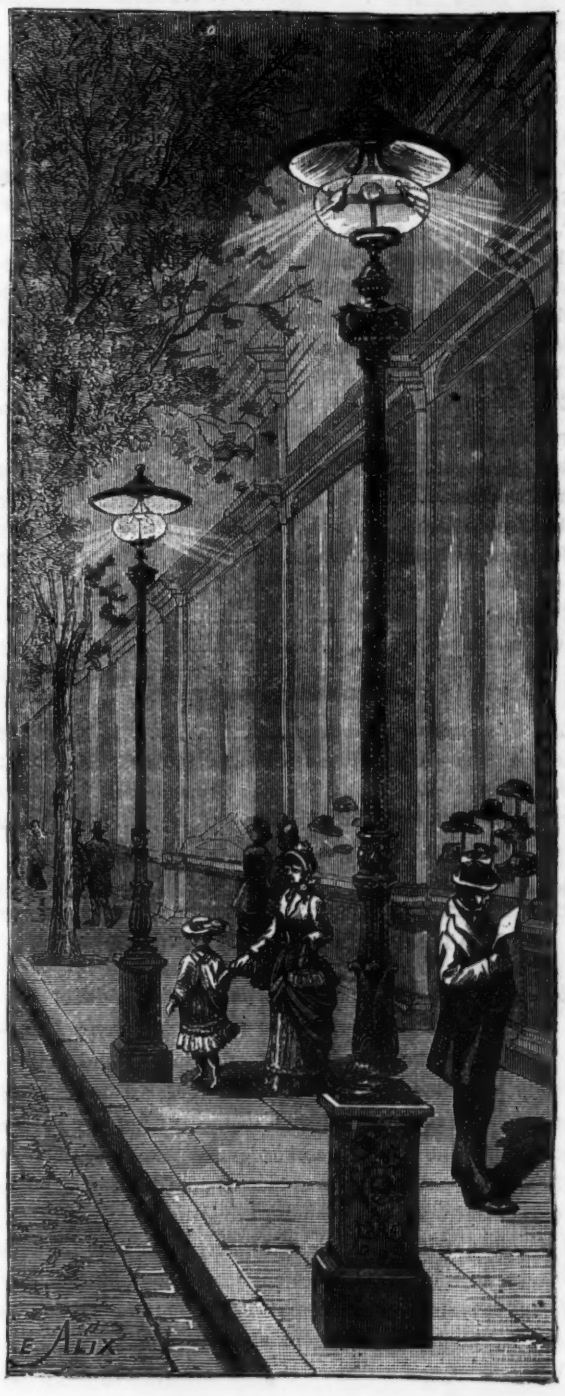

FIG. 6.

moment how completely it is at the mercy of Chicago accidents in the matter of telegrams, it will probably get up swearing mad. Not a wire goes East that does not pass through Chicago subject to Chicago accidents, and liable to be cut by an enterprising Mayor."

The Output of Telephones.

The net output of telephones by the American Bell Telephone Company for the month ending Aug. 20 was 3,569. This is the lowest of any month this year, and lower than in any month since September, 1881. The output the corresponding month last year was 4,678, and in 1881 was 5,021. The output for the first six months of the present and last fiscal year were as follows:

	1882.	1883.
March	5,192	4,739
April	6,690	7,342
May	7,469	6,758
June	6,362	7,088
July	3,787	5,846
August	4,678	3,569
Totals	34,178	35,292

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EDUCATING ELECTRICAL ENGINEERS.

Educational facilities are governed by the laws of supply and demand; the latter must be in existence before the former will even be thought of. Surely and imperceptibly, the knowledge that a void is created forces itself upon us, but it is not always instantly that the void is filled. In all the old arts and sciences, the providing of well-equipped training schools has been a matter of slow growth. An imperative demand brought them into being, and the good fruit they yielded gave them the impetus which led to wide-spread prosperity.

If, in forming our judgment, we confine ourselves strictly to the history of the progress of other sciences, we cannot even hope to have a perfect school in electrical engineering for many years to come. The development of all the other sciences was very slow in comparison with that of electricity. There was ample time for the student to become familiar with past customs while acquainting himself with the new. He knew the forces he strove to subject to his service and he knew what would result from changed methods. Actual discoveries were few and far between.

But if, when forming our opinion, we remember the changes which the college course has undergone, and the causes which led to them, then we may expect such training to be within the reach of all in the near future. It was not many years ago when the student took a classical course because there was no alternative, and no matter what his chosen calling might be, his education was considered incomplete without that. But the subjugation of new forces, the development of old and new countries, increased manufacturing facilities—all leading to a higher grade of civilization—combined to show the dignity of labor, and compelled institutions of learning to teach their pupil others than the polite arts. Consequently, innovations crept in. Elective courses were added. This proving inadequate, schools were inaugurated devoted to a particular art or science. Now we have schools teaching the specialties of the various subjects. But before all this was accomplished the people generally had to be educated to appreciate the advantages obtained. The beneficial results accruing from these changes have been mainly due to the good fruit they have borne.

In regard to electricity, we now have the demand for a technical school which will graduate thorough electricians; we have the students in great numbers who desire such an education; and we have no public prejudices to overcome. The science is extensive enough to occupy all the time usually spent in college; it is growing rapidly and continually; its future cannot even be guessed at. From a practical point of view, the demand for skilled electricians exceeds the supply tenfold. A letter which we publish elsewhere in this issue only makes our views the more emphatic.

Whether or no the science of electricity can be taught in a college is a feature of the subject which has many strong advocates on each side. Those in favor argue that by combining the practical with the theoretical such a knowledge can be obtained as will enable the student to understand the principles of appliances which are new to him; that he can be so grounded in the laws governing the current that he will readily perceive the mechanical details necessary to the using of the current; that it will all tend to more quickly aiding him to advance into as yet untrodden fields. Those against such plans urge that the mystery still clinging to the science, the difficulty of conceiving its action, the vast variations produced by seemingly insignificant mechanical alterations, cannot be mastered in school. They claim that practice is more essential than theory, and that this can only be obtained by long actual experience. To clinch their argument, they point to many electricians occupying the highest ranks and doing the advance work in the science who never saw the inside walls of a college. They say that the best work is being done by those who learned the science by making their own machines with a jack-knife and file; who, when want of funds prohibited a visit to the supply shop, covered their own wire.

Some of our leading colleges have recognized this want and devoted chairs to the science. The experiment is too young yet to judge of its efficiency. We cannot do better than close by stating a remark credited to Mr. Edison. He said that he had tried the purely practical man without satisfaction; that the purely theoretical was not better; and that he now wanted a happy mixture of the two.

The Question of Postal Telegraphy.

The Chicago *Tribune* reports an interview with Mr. Edmund Rosewater, editor of the Omaha *Bee*, who was an operator before, during, and since the war, covering a period of over 13 years of service, during seven of which he was the Western Union Telegraph manager at Omaha. At the outbreak of the war Mr. Rosewater was in Nashville. From what he saw in those days he favors the ownership of the telegraph by the government, among other reasons, as a military precaution, because, had the telegraph been in loyal hands then, he believes the war would have been ended within twelve months. He regrets that the thousands of miles of telegraph wires and cables laid by the Federal government during the struggle passed into private hands "for a mere bagatelle." As early as 1870 he wrote a letter giving his experience as a telegrapher to Congressman Washburn, who introduced a measure, which did not pass, providing for the government control of the telegraph. The year after, as a member of the Legislature of Nebraska, he introduced a resolution favoring this arrangement, although his action therein subjected him to the censure of the officers of the Atlantic & Pacific Company, in the service of which he was at the time employed, as manager of its wires at Omaha. He thinks government control would not tend to centralize power and increase the patronage of politicians, because it takes five years to make a good telegrapher, and government telegraphers should have life positions, and be graded and advanced as they earn promotion. Moreover, he believes that it would be as easy to prevent espionage by telegraphers as the abuse of their positions by post-office employés in the opening of letters is now prevented. Penalties could be provided in that case as in this sufficiently severe to prevent the abuse. The last point made by Mr. Rosewater is that the telegraph in government hands would be made as universal as the post-office, and would thus provide the people with a means of communication equally widespread, whereas now private companies open offices only where they think it will pay them to do so.

Mr. Rosewater's argument, which we state fairly and at such length as does him full justice, is, we submit, open to such criticism as at least shows it to be inconclusive. Had the government owned the telegraph wires in the seceding States at the time of secession, and had the telegraphic system in those States been as universal as the post-office, the advantage would, in all probability, have been with the Confederate authorities, who could just as readily have taken possession of Federal property in the shape of wires, instruments and buildings, as of the post-offices, and have facilitated their intention to consummate secession by these acts. Moreover, it does not seem to be reasonable that a particular mode of communication should be adopted as a preparation for the event of civil war, even were all that Mr. Rosewater claims in this regard undeniably true. What possibility is there of a renewal of civil strife? Were war to break out between the United States and Mexico or Great Britain, how easy it would be for the wires connecting this country with our Southern and Canadian neighbors to be rendered valueless to them; and, on the other hand, either of these countries would have a similar safeguard against our abuse of the telegraph to its prejudice. In the matter of Mr. Rosewater's heroic sacrifice of the interests of his employés to the strength of his conviction on the subject of government control of the telegraphs, this proves nothing either on the one side or the other. As regards his position that excessive centralization and partisan patronage would not result from the change he advocates, were the fact different in the case of the post-offices, his argument would have the greater weight; nor does it seem to us that the long period of time that it would take to render one a proficient operator would necessarily prevent the possibility of there being abundant applicants for employment as such under the authority of the government. Party keenness for patronage, supported by the frequency of elections and the influence which such patronage indubitably possesses to determine the result of elections, is not likely to be abated because Mr. Rosewater and others so desire. The point having reference to the prevention of disclosure of the contents of telegraphic messages, has no force that we can see. The contents of messages, many of them containing secrets of great political and commercial importance, are held sacred by the operators of to-day; and we think that, were Mr. Rosewater's plan to come into operation, no Draconic code would be necessary in order to insure trustworthiness on the part of those intrusted with the receipt and sending of telegraphic messages. There is force in the claim that government ownership and control would insure the more universal use of the telegraph; but we fail to see that it necessarily follows from thence that government should own and control it. Why not apply the same argument to railroads? The post-office is an inheritance—and an invaluable one—from times very different from these. Its continuance is a very different thing from the adoption, in this age of the world, of a scheme of communication which would include the multiplication of Federal officials, and would check that spirit of enterprise fostered by limiting rather than increasing government action in behalf of the citizen. Abuses in the present system do not afford an argument for its abolition.

We find it necessary to look further than to Mr. Rosewater's argument, as reported, for reasons why a government monopoly of the telegraph should supersede its provision by the brains, capital and enterprise of American citizens.

The Western Union on the Stand.

During the latter part of last week and the early part of this, the time of the Sub-Committee of the United States on Labor and Education (convened in this city), was spent in listening to the statements of Dr. Norvin Green, president of the Western Union Telegraph Company. Long and intimate acquaintance with every branch of the telegraph business, and the magnitude of the corporation he has been so long identified with, combine to make any direct and truthful assertions with which Dr. Green might favor the public exceptionally valuable. But when a man of his calibre, upon being questioned on subjects which the people ought to know, and in a certain sense have a right to know, hides himself behind transparent sophistries and timid innuendoes, fearful lest others should rob him of the secret by which he pays ten per cent. on eighty millions of dollars of stock—two-thirds being water—surely he hides his candle and with his cronies huddles in a heap under the bushel. In his testimony, occupying three or four days, we are unable to find but an insignificant amount of wheat—and we are not certain about the soundness of all of that.

He had watched the growth of the telegraph systems of this country from the time the congressional appropriation of $30,000 was made in 1847, for the purpose of experimenting with the Morse system. An underground wire was first laid between Baltimore and Washington, but as the knowledge of insulation was not advanced at that time, the current was lost. Even at the present time he was of the opinion that it would be troublesome to lay an underground wire that distance.

In 1854 Dr. Green actively entered upon the telegraph business. The Western Union was organized in 1851, and began operating two years later, and since then has ab-

sorbed sixty smaller companies. As the Western Union lost money the first few years, it was compelled to issue stock to pay its indebtedness. Many small companies were soon after started in the South and West, but they were failures. The American picked up a few and the Western Union sheltered the balance. In the early days the cost of maintenance was excessive. Test stations were built every 40 miles, and from these gangs were sent in wagons to make repairs, as there were no railroads. In 1866 the United States Telegraph Company, which had lines to Salt Lake and the Northwest, was taken up by the Western Union, and soon after the American Telegraph Company, which covered the Southern and New England States, shared a like fate. In that year the Western Union was completed through the United States. Its capital was $41,061,000. This represented $600 per mile of wire. Now its stock represents $200 per mile of wire. The miles of wire have increased from 75,000 to 430,000. The number of miles of poles is 150,000. The offices number 13,500. The number of messages sent this year will probably reach 43,000,000, against 5,000,000 in 1866. The next report will show the receipts to have been $19,000,000 and the expenses $11,000,000. During the past five years the increase in the number of messages amounted to over 83 per cent. The character of the service had improved. Messages between the Chicago Board of Trade and the New York Produce Exchange for several days in June had been as follows: June 1, 375 messages averaged 30 seconds; June 2, 258 messages averaged 22 seconds. From the Stock Exchange 2,459 messages averaged 1 minute 45 seconds. From the Broad street office 5,592 messages averaged 1 minute 44 seconds. According to statistics the time of a message from Antwerp or Paris to London averaged two hours; from Bremen to London, one hour. In a week's time, taking in both night and day messages, the time was as follows, between the cities named below: From Rome to London, 27 messages, 2 hours and 43 seconds; from St. Petersburg to London, 13 messages, 1 hour and 46 seconds; from Brussels to London, 7 messages, 1 hour and 10 minutes; from Berlin to London, 3 messages, 1 hour and 7 minutes; from Constantinople to London, 4 hours per message. These messages averaged 40 words.

In regard to the rates in this country, Dr. Green stated that the Western Union was much the largest system in the world, and was equal to those of Great Britain, France, Austria and Germany combined. It had long distances to cover—one line is 4,500 miles long—and he did not think a uniform rate practicable. Taking into account the long distance, it was the cheapest telegraph line in the world. European prices are as follows: London to Austria, 700 miles, 9 cents a word; London to France, 200 miles, 5 cents a word; London to Germany, 500 miles, 6 cents a word; London to Italy, 800 miles, 8 cents a word.

In explaining the expenses of the company it was stated that the standard salaries of the average paid operators were $70 per month. The higher officers had once been office boys and messengers. The company had, in reality, paid its apprentices by employing them as messengers, while at the same time teaching them telegraphy; it was a sort of a Cooper Union affair on a large scale, but lacking the grand principle which forms the foundation of Cooper Union. The average salary in all the country and city offices is $64.90. The statement that salaries were being constantly reduced was a mistake. After the panic of 1873 all salaries were reduced; the president's, 25 per cent.; all salaries of $5,000, 15 per cent.; under $1,200, 5 per cent. Since then the wages have been increased. It was pronounced untrue that the tariff went up as the salaries went down. Female operators were as well paid for the work they did as the men.

Jay Gould owns most of the Western Union stock, but not a controlling interest. Later in the testimony, it was stated that the largest stockholder held between $25,000,000 and $30,000,000 of the stock. A Government telegraph was believed to be less effective than lines owned by private parties. The sanctity of messages has been preserved for both political parties. None of the officers above the grade of managers has any access to messages.

The payment of the operators is governed by supply and demand. Good operators are constantly changing to some other business. The company thought it paid its operators at rates which compared well with those paid by other companies for the same degree of intelligence and amount of work. When the strikers went out, Dr. Green thought it would have been fatal for the company to have acceded to their demands. The company looks with disfavor on all organizations going beyond a benevolent and protective limit, and menacing the interests of the company while not doing its employés any good. When asked if the Western Union, as well as other large corporations, ought not to pay their employés better wages, from the broader sense of justice and charity, the doctor replied that corporations were organized to make money, and were not of a charitable nature.

In order to get at the actual value of the plant it would be necessary to go into the history of some sixty different telegraph companies. When asked as to the cost of replacing the plant, Dr. Green said that if he owned it and felt secure against antagonistic legislation, he would not sell it for $100,000,000. The patents now unexpired probably did not cost over $1,000,000. On telephone patents the Western Union receives from one company $300,000 a year in royalties. This is a part of the assets of the company. It is the policy of the company to cover the whole country, and to do this it proposes to take in some companies which cover fields it could not reach. The Doctor did not "think" it was the policy of the company to crush out other companies; and when asked if it had pursued this policy in the past, he said that an idea of that kind had existed. He further said that the stock of the Western Union had not been watered, but, on the contrary, it had been "distilled."

When the witness was asked his early history and how he became connected with the telegraph interests, he said he was a native of Indiana, and had spent his youth in work, cutting wood, and on the flat-boat. In this way he got together enough money to pay his way through a medical college. Then he practiced medicine for twelve years. He dabbled in politics a little, and finally went to Chicago at a time when the telegraph lines were in poor condition. Becoming interested in the subject, he accepted the Secretaryship of the St. Louis and New Orleans Company, and soon became its President. Afterward he was Vice-President of the American Company, and when that company was absorbed by the Western Union he was elected Vice-President of the last named company.

The remarks at the beginning of this article will apply equally well to the next witness brought before the committee, Mr. Jay Gould, who occupied the stand when the committee met on the 5th inst. He gave a brief sketch of his personal career. He was born in Roxbury, Delaware County, this State, on May 27, 1836. His father kept a dairy of twenty cows and was a small farmer. The future millionaire, being the only boy in the family, was obliged to watch the cows and assist his sisters in milking. When trudging along the roads barefooted he often got thistles in his feet. He did not like the life, and told his father he wanted to go to school. After persistent effort the old man informed him he was not worth much at home, and he might do what he pleased with his time. He started off when fourteen years old. He found a blacksmith who boarded him and let him go to school, he, in return, writing up the smith's books. When a year had passed, he got a situation in a country store, and many a time got up early in the morning to study. An early fondness for mathematics led him to surveying. He was engaged by a man who was making a map of Ulster County, the wages being $20 a month and board. At the outset he only received money enough to pay his railroad fare to the point where he was sent. He was to go through the country, gathering information and obtaining his board wherever he could. He was to get trusted along the way, his employer following and paying the bills. At a country tavern where he lodged, the landlord told him that his employer was "no good." By turning out his pockets young Gould proved to his host that he had no funds wherewith to settle his bill himself, and he was allowed to pass on. This so disheartened him that he feared to ask at any place for his dinner, and seeking a secluded place, he had a good cry. Then he went to his sister's house and, going up-stairs, prayed, after which he felt better. He then went along the road and at the first house, asked for, and obtained, his dinner. As he was leaving the farmer asked him to do a simple job in surveying for him. (The job was to make a noon mark. After this he paid his way through the country, making marks for the farmers at so much a piece, or, in some cases, for a meal.) For this work he received one dollar, and after paying one shilling for his dinner he had seven left. He finished the map of Ulster County, making $500 out of it, and with this capital undertook similar surveys in Albany and Delaware counties. From the sale of maps he realized $5,000. He then went into partnership with Zadoc Pratt, in the tannery business, in Pennsylvania. This venture proved successful, but after awhile Mr. Gould sold out and came to New York. During the panic of 1857 properties depreciated in value and Mr. Gould bought, on credit, the bonds of the Rutland & Washington Railroad at ten cents on the dollar. He conducted the road until its consolidation with the Rensselaer & Saratoga road, when he sold out at a large profit. Subsequently he took a large interest in the Cleveland & Pittsburgh Railroad and held it until he was able to sell it to advantage. The history of his dealings with various roads would fill a volume. Although now a director in many roads, he stated that it was his policy to keep his interests concentrated. He thought the railroad and telegraph systems naturally go hand in hand.

The Western Union has contracts with railroads which extend over 115,000 miles of territory. By these contracts the company agrees to do the legitimate telegraph business of the railroads, and in turn the railroads give the company free right of way over their territories, free office rent, and pay the larger part of the wages of the operators in the railroad offices, who are for the most part railroad employés. If the Western Union Company had to pay full salaries to all of its operators (about 25,000), it would cost more than the gross earnings of the company. He did not think it possible to operate a line of telegraph independent of the railroads. He thought the control of the telegraph by the Government would be contrary to our system. It should be in the hands of experts. He said he thought the government should pay what the property was worth; he would be willing to abide by a fair arbitration. In answer to the question as to the cause of labor strikes he said that they arose from the lower classes of laborers. In the higher grades the workers do not care so much about how many hours they work, or how hard they work; they are always looking higher up. The prevalence of strikes at the present time is caused by a surplus of a certain kind of labor, brought about by contractions of large enterprises, which brought the laborers here. It is impossible to adopt any general rule to prevent poverty or to ameliorate the woes of the poor, but the witness had noted that "if a man is sober, honest and industrious, he generally gets along." In regard to labor organizations he said that any society that has for its object the education or legitimate advancement of its members is a good thing. He wound up by saying that he did not believe an absolute monopoly was possible in this country.

The Electric Railway in America.

Our English contemporaries, *The Electrician* and *The Electrical Review*, of London, reproduce in full our leading illustrated article of Aug. 4 on "The Electric Railway at the Chicago Exposition." The latter also takes occasion to comment editorially on the subject of electrical railways in general as follows:

"The description we give this week of the electrical railway recently in operation at the Chicago Exhibition of railway appliances, will, no doubt, be read with interest. In America the subject has not apparently been investigated to the same extent as in England and parts of Europe, and this is rather to be wondered at when we consider how much more has been accomplished on the other side of the Atlantic in electric lighting matters. That such methods of locomotion will in any way seriously interfere with our present mode of employing steam-power we do not believe, any more than that the general introduction of the electric light would cause a diminution in the consumption of gas; but we do think that in several existing instances electricity might beneficially take the place of steam, and be employed in innumerable cases not yet entertained. Passengers, the whole world over, must be conveyed by some means or other from place to place, and surely in many parts of England short lines could be laid down and profitably worked.

"It has often been urged that the weight of the locomotive can be reduced many times by the employment of electricity; but, on the other hand, the great weight of a steam locomotive is positively necessary to obtain a grip on the rails when drawing a heavily-loaded train. Our ordinary locomotives again, carrying their own fuel, can exert their maximum power wherever necessary; this cannot, however, be accomplished on an electrical railway, where the power is supplied from a fixed point. With secondary batteries, of course, such a result would be possible. It is, however, premature to speculate on what can or what cannot be accomplished in this direction, and we must therefore patiently await the outcome of enterprise.

"So much capital has been literally thrown away on electric lighting that at the present time it is exceedingly difficult to find capitalists with sufficient faith and courage to finance anything electrical. Electrical railways and the electrical transmission of power appear to us promising subjects for both inventors and capitalists, and were the same amount of talent and energy devoted to the development of these as was expended last year in electric lighting, we venture to say that a more profitable return to shareholders would be the result."

We indorse the remarks of our contemporary as in every way sensible and warranted, and as being in the main the expression of our own opinion on the subject. The compliment paid to American success in the field of electric lighting is accepted with grace, as being well deserved. No doubt the modesty of our contemporary, or his desire to stimulate no excess of vanity in us by giving us too much credit, has led him to stop short in telling what has been accomplished on this side of the Atlantic, viewing the Chicago electric railway itself as an "accomplishment." It is undoubtedly true that less attention has been given to the electric railway in America than in Europe, but this does not prove, in our opinion, that we are lagging behind in this respect. As we pointed out in the article of Aug. 4, the Chicago experiment is not representative of the present state of the art in this country. But when in two weeks, and from the most incompatible material, an electrical railway can be made that gives such results, it shows that the subject has matured here as well as elsewhere. There was no time for a minute study of details and for the deliberate consideration of all the conditions of economy, but what was aimed at was to show the *functions* of an electric railway. In this respect, "The Judge," crude as it was of necessity, will make a fair comparison with any of its European colleagues. Indeed, we are under the impression that it presents features of perfection and of completeness in the adaptation of means to ends which our European cousins might study with advantage. We hope that the American electrical railway will soon be placed anew before the world, this time with its best foot forward, as the saying goes, and we are confident that it will then be evident to all that we are keeping on apace with the rest of the world in this new electrical art.

A Concession to the Operators.

It is gratifying to note that the Western Union seems disposed at last to recognize the fact that its employés had reasonable cause for their late rebellion, and it is probable that some of their grievances will now be remedied. Last Saturday the directors of the company issued an order which reduces the working days of the operators from 30 to about 26 days a month. The order is as follows:

"Commencing to-day, seven and a half hours' actual service in this office during week nights will constitute a day's work, or, in other words, the hours of the night force will be from 5:30 P. M. till 1:30 A. M., allowing 30 minutes for lunch. Sunday service will be paid for the same as other overtime services at the rate of one-seventh of a day's pay for each hour. All payments for overtime, including Sunday service, or for a fractional part of a month, will be based upon the number of week days in the month."

If the company had promulgated such an order as this several months ago, and followed it up by other little acts of justice—as we hope it will now—we should have had no strike, and the company would have been spared the great incidental expense and annoyance. It is to be hoped the company will go on and make such other concessions to its deserving employés as will render them satisfied and contented; and if it does it will be found that the money thus expended has been well invested, for men who feel that their services are adequately remunerated will do so much better work, and be so much more solicitous of the interests of their employers, that the extra amount paid in salaries will be more than made up to the company.

The Analysis of Ohm's Law.—III.*

BY JOHN T. SPRAGUE.

27. *Contact and Chemical Theories.*—From the first days of the discovery of current electricity two theories have been maintained to account for the origin of the "electromotive force." One school contends that the current is due to a *force* set up by the *contact* of heterogeneous bodies, by which a disturbance is effected in the supposed normal distribution of electricity, assumed to be a constituent of all bodies; another school attributes the origin of the current to the action of *chemical affinity*.

28. The *contact theory* has undergone various changes. At first it was held that the force originated at the point of contact of the *two metals* of the battery, say, copper and zinc. Faraday demonstrated the production of voltaic electricity when no metals were in contact, and by a number of proofs absolutely demolished the contact theory in this form; and established the chemical theory by proving, on the other hand, that no electricity was produced except as an accompaniment of chemical action. Then the contact theory was modified so as to include the contact of all heterogeneous substances.

After some time the idea was added that *contact* is the source of the electric *force*, but that *chemical action* was necessary to supply *energy* to maintain the current. Brought into this compass, the matter seems to be reduced to little more than a squabble about words.

29. The *molecular* theory of electricity does, in fact, set aside both these theories by showing how far both are true, for it shows that electric polarization must needs occur whenever two heterogeneous substances come into contact under the proper conditions.

This "contact," however, is no new mysterious "force" or "difference of potential;" it is the ordinary chemical force of affinity (be that what it may) exerting itself upon *all* its surroundings, whether *within* the molecule constituted by virtue of its action, or *upon the external molecules* brought within its range by this act of contact, which merely means a close neighborhood, allowing force to distribute itself upon the universal law of the inverse square of distance.

Therefore, this theory is really the chemical theory developed, and sets aside the contact theory; and, although this may seem to be a mere verbal distinction, there are principles of deep importance underlying it. The point is, whether we have a right to invent some new "force" whenever we want to explain something, or—perhaps more truly—to adopt some sounding word to wrap our ignorance in, and then offer that word as an explanation of the facts we do not understand.

30. There is also a wide distinction between the two theories; the contact theory is essentially *atomic*, and the chemical theory *molecular*. I hinted at this some time ago, and it may sound mysterious at first, and be unmeaning to many, but it involves two widely diverging lines of thought. It will be unmeaning to the purely mathematical mind, which deals with artificial creations and abstractions, and whose natural property the contact theory is. It requires the physical training of chemistry to appreciate; but I will explain my meaning.

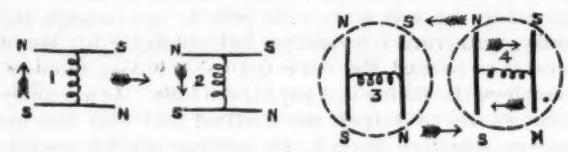
31. There is a theory of electrolysis which we may call 'the dance of the atoms." It is supposed (on this theory) that molecules have not the absolutely defined construction involved in chemical formulæ; that a coppering solution, for instance, does not consist of fixed molecules H_2O, SH_2SO_4, and $CuSO_4$, but that these molecules are merely temporary formations, and their constituent atoms are perpetually interchanging among themselves, like the adies and gentlemen in the figure known as the "grand chain;" or, better still, like the gnats one may see on a summer evening flashing here and there and circling for a moment around each other. This strange idea was invented in order to explain why *ions* pass to the two electrodes. These are imagined to exert a force of attraction, each for its oppositely-electrified ion, which during its free moments in this "dance" is gradually drawn over.

32. There is *not a particle of evidence* to support this theory; it is a mere figment of the imagination, and is wholly opposed to the known laws and facts of chemistry, and especially inconsistent with the known facts of the thermo-chemistry; but it just suits the mathematician as distinguished from the physicist, because he seeks to isolate every idea and fraction of an idea and property and ticket it with a symbol, which he then deals with as a kind of individuality or "person."

But the chemical mind, trained perhaps too much the other way, and dealing with concrete bodies, treats the combination of the atoms in a molecule as a rigid, definite union. To the chemist this molecular unity is a true marriage rather than the promiscuous intercourse of this other theory. He is shocked at the idea of any dissolution of the bonds of chemical affinity, except in the form of a higher affinity, a stronger force which, like death, breaks the original union only because it removes the two parties to it to new and distinct spheres.

Thus it is that the contact theory is related to the *atomic* forces, while the chemical theory is related to the *molecular* forces.

33. The *molecular theory* may be defined thus: The atoms of matter are endowed (how matters not) with differential attractions, and apparently, with polar properties, which we may conceive by the figure of infinitesimal magnets, all having N and S ends, but having different magnetic capacities. These atoms unite together in pairs, which partially satisfy each other's polar requirements in a manner which the figure may explain. 1 and 2 represent molecules, held together by forces of polar attraction, represented by spiral springs. They, in fact, resemble pairs of "astatic needles." When they approach to other molecules the closed system acts externally in part, and unites the molecules together, though with a force more feeble than the internal affinity. 3 and 4 convey the same idea more fully. In 3 the internal attraction is shown strong. In 4 it is shown weakened by part of the attractions being diverted externally to the nearest atom of the approaching molecule. This is the action which is correctly described as *electric polarization*, a weakening of the internal affinities, a tendency to disruption of the molecule by external affinities, and this difference between the internal and external affinities is the E.M.F. of any chemical action, or the measure of the so-called "contact potential," the development of which is thus rendered intelligible.



SPIRAL SPRINGS HOLDING THE LINES TOGETHER WITH VARIOUS FORCES.

34. These forces are forms of energy, and are measurable directly in terms of energy. The strength of any chemical affinity constituting a molecule is measurable in terms of the *heat of combination*. This is the value corresponding to the spiral springs of the figure. The strength of any chemical affinity tending to break up existing combinations, and to produce new ones, is measured in terms of *the heat set free by the reaction*—that is to say, by the difference of the intrinsic energy *potential* in the first state, and that remaining *potential in the products*. This is easily and usually measurable as heat, and this general recognized fact is embodied in what Berthelot calls the law of *maximum work*.

35. But this is only a phase of a general law of electrical action, which I will formulate thus: *Wherever there is free energy present* (as heat in a thermopile), or *wherever there is potential energy seeking to become free* (as when chemical affinities can come into play) *in presence of differential molecular structures, or conditions, so arranged that a closed polar chain can be completed, then energy takes the form of electromotive force or electric potential.* The quantity of energy associated with any particular molecular condition, or capable of action upon the definite molecular chain is the measure of the degree of electric potential due to the particular condition.

36. It is perfectly well known and admitted that electromotive force is expressed by the potential energy of any chemical affinity connected with it, even by those who maintain the contact theory. It is a certain fact that in electrolysis the art of breaking up a substance into a simpler condition, such as deoxidation, involves the presence of an E.M.F. which takes no part in the production of current, and must be written as $-e$, in order to reduce the E apparently available for that purpose. This $-e$ is just equal to the positive E.M.F. which the corresponding reverse act of oxidation will produce. On the other hand, it is well known that some energy disappears, which is not accounted for in the R of the circuit, and this energy, again, is exactly that corresponding to the chemical union broken up. Here, then, we have the two terms of E and energy connected as equivalent.

37. This is commonly stated in the following manner: The work done in transmitting electricity is as $E \times Q$ (which is simply $E \times C$ in another form, not reckoning time, as $C = Q \div T$), and the same formula applies to doing this against an E.M.F. as in a decomposition cell. In this case a chemical combination is reversed, of which, in most cases, the calorific equivalent — *i.e.*, the potential energy, in the form of heat, has been determined.

Let H represent the heat of combination of 1 gramme of a substance, say, taking Favre's values, hydrogen = 34462 combining with oxygen, and zinc passing to its sulphate = 1623 calories.

Let A be the ampère or coulomb equivalent of the substance, say ·00001022 gramme for hydrogen and .00033324 for zinc, multiplied by 10 to bring it to the C.-G.-S. unit of quantity, the coulomb being 10^{-1} of this.

Let J be the mechanical equivalent of the calory in ergs 42,000,000, 42×10^6 or 4.2×10^7.

Then, the volt being 10^8 absolute units, we have

$$E \times Q = Q \times H\,A\,J,$$

and an arithmetical result of this is that $E = H\,A\,J$, which means that E, or E.M.F., is equal to energy, which will be made plain by the following examples:

In the case of hydrogen burning, or in a gas battery we have

H = calories	34462 =	Log. 4.5373405
A = "	.00001022 × 10 =	-4.0095453
J = "	42,000,000 =	7.6232493
	Energy in ergs	8.1701351
Volt = C.-G.-S. units 10^8	=	8.0000000
E.M.F. in volts due to H and O		0.1701351 = 1.480.

This is the experimental value of the reaction as nearly as observation can be expected to agree in the present undefined state of several of the data concerned. Dr. Alder Wright, in making the actual comparison, found it to be 1.5038.

In the case of zinc forming sulphate we have:

H = calories	1623 = Log.	3.2103185
A = "	.00033324 × 10 =	-3.5227571
J = "	$\frac{4.2 \times 107 \text{ as before}}{10^8}$ =	" -1.6232493
Volts of E. M. F. due to zinc	= "	0.3563245 = 2.272

Then 2.272 — 1.480 = .792 gives us the combined action of zinc dissolving in acid and giving off hydrogen.

38. Hence we have this definition: *The E. M. F. corresponding to any chemical action is equal to the product of the equivalent weight of the basic ion and of the heat of combination of the two ions* expressed as C.-G.-S. units of work; that is to say, when all the elements are reduced to the absolute system.

It appears difficult to understand how, in the face of such a fact and such an accepted law, any one can dispute the statement that E. M. F. is merely a metamorphosis of chemical affinity, or talk about *contact* potential in face of the evidence that both chemical affinity and E. M. F. are forms of energy, correlative, convertible, and expressible by indentical figures.

39. The foregoing calculation and formulæ are useful in order to follow out a line of reasoning, and to put the facts in the form adopted by most writers. But there is a much simpler mode of calculation, and one which has the great advantage of leading us up to a natural law instead of a mere arithmetical expression.

Let H be the heat in calories per *gramme equivalent*, in which form it is commonly stated, or which can be calculated from $H\,A$ above.

Let J be the calories corresponding to 97808.5 ampères (that being the time in which an ampère current effects 1 gramme equivalent of electrolysis) × by the joulad (in calories) the work of 1 ampère = 23287.7 Log. 4.3671271.

Now $H + J$ is the E.M.F. in volts due to the reaction. Thus we have

H = hydrogen	34462	Log. 4.5373405
J = "equi-volt"		4.3671271
E.M.F. of H + O, as before		0.1702134 = 1.480.

37. THE EQUI-VOLT.—I must now explain this term and unit of my own. It is compounded from "equivalent" and "volt," because it expresses *energy in the terms of one volt of E.M.F. under unit conditions of current and resistance, but correlated to the true* natural *unit of electric quantity*, the chemical equivalent of matter to which electricity is connected, and the neglect of which makes the nature of electricity incomprehensible.

The ordinary system of measurement is based upon energy, and the definition of electric quantity is purely artificial. The description of quantity in the form of dimensions as $M^{1/2}$, $L^{1/2}$, has no meaning except in connection with energy related to it. Yet the best known of all the facts of electricity is that which corresponds to the idea of a physical quantity—viz.: the definite chemical relation of a quantity of electricity, or current, to a fixed equivalent of matter. This relation is comprehensible when we realize that a "quantity of electricity" means really a definite molecular action, most perfectly realized by the mind in the form of one of those molecular impulses described § 33.

The equi-volt, therefore, is simply the energy associated with one such impulse under the conditions of unit force, and in a chain of unit resistance. The actual quantity attached to it will be varied just as is the actual quantity connected to a chemical equivalent or atomic weight, which may be milligrammes or tons with equal correctness.

The value given to it in § 36 is that belonging to 1 gramme of hydrogen or the equivalent of any substance, which has

*London Electrician.

the advantage of forming a part of the volt and coulomb system. The only objection to it is its magnitude as compared to the ampère current, but even this is no disadvantage in many applications of electricity, and especially in connection with light and metallurgy.

But it is more convenient for some reasons to use a value related to our English system of measures, such as the foot-pound. There is no difficulty about this, as we need only multiply the value in calories (such as are used § 35 and 37) by .198547 or Log. –1.2977983, when we have the corresponding expression in "foot-pounds per grain equivalent;" which is, in fact, the work corresponding to an ampère current for 6,338 seconds, during which one grain of hydrogen is set free (as in a Smee cell). This value is 4,673 foot-pounds, and this form of the equi-volt I shall use.

The Telephone in Chicago.

It seems likely from present appearances that within a short time the Chicago Telephone Company will have a rival in the field. This probable competitor, whose representatives are already on the spot, is the People's Telephone Company, which owns what is known as the Drawbaugh invention. Some years ago the statement was published that the original inventor of the telephone was not Prof. Gray or Prof. Bell, but a man from the centre of Pennsylvania by the name of Daniel Drawbaugh, who claimed that he had invented a speaking telephone as far back as 1869, which, if correct, antedated by several years the inventions of his better-known competitors. Very little attention, however, was paid to this claim of the gentleman from the recesses of Pennsylvania, and public interest in the subject was chiefly concentrated on the fight between Messrs. Gray and Bell—a contest which was finally decided in favor of the latter. In the meanwhile, however, Drawbaugh and his representatives have gone on with their case, which has been in progress for about three years. Nearly 1,800 pages of printed testimony have been taken, and several hundred thousand dollars paid to some of the ablest lawyers and experts in the country. The present status of the case is this: The Bell interest has taken its prima facie testimony; the Drawbaugh interest its evidence, showing priority of invention; the Bell its rebuttal, and the Drawbaugh interest is now engaged in taking its surrebuttal testimony. It will probably be decided this fall in the Circuit Court for the Eastern District of New York. If it should happen, as the Drawbaugh people profess to be confident will be the case, that the Judge decides in favor of Drawbaugh's priority of invention, active operations will be begun. Of course, the case will be appealed by the Bell Company to the United States Supreme Court, but it will be three, four or five years before a final decision is reached, or about half the life of the present Bell patents, which, unless extended, will expire ten years from now.

It is the intention of the Drawbaugh people, assuming always that they get a decision in the lower court in their favor, to go right ahead with the manufacture and renting of telephones and the creating of telephone exchanges during the time between that decision and the time that the Supreme Court finally passes on the matter, taking the chances always that its final decision will be in their favor. Should they get a judgment in the lower court there will be nothing to interfere with their doing this, because, having this preliminary decree, they cannot be enjoined from making and renting their telephones.

Early this month a syndicate was formed in New York which has already incorporated the Drawbaugh Telephone Company. The People's Telephone Company of Boston has acquired from the People's Telephone Company of New York the exclusive territory of the New England States, and has capitalized at the sum of $5,000,000. The total amount of capital back of the New York company is understood to be about $15,000,000.

As soon as it was decided to begin operations this fall in case of a favorable decision of the lower court, representatives of the Drawbaugh interest came on to Chicago for the purpose of studying up the situation here. Chicago is known to be about the best telephone field in the country, and naturally attracted their early attention. There are about 3,000 subscribers to the present telephone company in this city, and it was expected that the prospect of lower rates—for it is understood that the Drawbaugh company, when it begins, will rent its instruments for $75 a year—would not only take away some of the customers of the present company, but also induce large numbers who think the existing rates too high to join in a new exchange.

Nothing has been done as yet, however, in the way of making a canvass, because the first thing to be considered is the problem of running wires. That is a question that has to be settled with the Council, and that body will not assemble until the end of next month. To get permission to run overhead wires is not practicable. A conference was had, it is understood, with the managers of the conduit system to see how far their franchise could be utilized, but it seems to be the impression that it can be made use of, if at all, only to a limited extent. So the present idea is to resurrect the short pole ordinance which was introduced in the Council last spring, was vetoed by the Mayor, and which failed to pass over his veto. It is hoped by the Drawbaugh syndicate that, by the expenditure of a moderate amount of money, such an ordinance can be gotten through which will enable the new telephone company to run wires, without which it is practically useless for it to try to begin operations here. Whether the company will be willing to pay the price which the professional foreigners of the Council are in the habit of charging for necessary ordinances is doubtful, for they will probably want $40,000 or $50,000. This is a heavy outlay to start with, especially as, even without this preliminary expenditure, a telephone company, considering the first cost of its plant, cannot expect to make any money for about two years.

As yet no Chicago capitalists, it is understood, have been interested in the enterprise, but it is not unlikely that they will be approached on the subject within a few weeks, and may conclude, in view of the prominence of some of the Eastern parties, to take a hand in it.

This feeling of uncertainty as to the decision of the court in the Eastern District of New York has seemingly had some effect on the stock of the Bell Telephone Company, which has sold down from 298 to 235 since February. From this drop, however, it may soon recover, for the decisions of courts are never certain, and it will be some weeks yet before the Drawbaugh people will have made their full arrangements for commencing business in case they do get a decision in their favor.—*Chicago Tribune.*

The Telegraph Lines of Which the Western Union Was the Outcome.

In answer to a question as to when his attention was first called to the science of electricity as a practical thing, Mr. J. H. Wade, of Cleveland, said:

"It was in 1847 that my mind and hands were first turned in that direction. I took a contract to build a line from Detroit, Mich., to Jackson, in the same State. We pushed it through as rapidly as circumstances would allow, and finished it during that same year."

"A one-wire line?"

"Yes, we strung only one wire in those days. It was a frail affair, costing from $60 to $70 a mile, while a good one now costs from $100 to $150. When we reached Jackson I opened the office there. They shipped me an instrument, and I set it up and went to work. The next season Cleveland. The following year, 1849, I began the erection new territory was opened. There was a line run from Detroit to Milwaukee, and another around to Buffalo, by way of a line of my own from Cleveland to St. Louis, by the way of Cincinnati, which was finished in 1850. The next year we changed the route from here to Cincinnati, so as to follow the railroad. The O'Reilly line, from Buffalo to Detroit, was built at the same time as the Morse line, along the same route. The business increased rapidly so far as lines were concerned, and competition developed as rapidly. It was in 1852, I believe, that the House line was run from Buffalo to Cincinnati. At the same time the Morse service was extended over Indiana and Illinois. I think the first step from a losing to a self-sustaining business, and ultimately to a paying one, was taken in 1854. Our first move was the bringing together of the lines which I controlled and the House lines, controlled by Rochester parties. I remained as general agent of the consolidated lines. That combination gave us control of the routes from Buffalo, St. Louis, Chicago, Detroit, Cincinnati, Cleveland, Milwaukee and intermediate points. Thus started on the road toward a successful business from what had threatened ruin through rivalry, competition and duplication of expenses, we saw our way clear, and line after line was added. The Western Union Company was the outcome, and the later's history is pretty well known to the public."—*Correspondence N. Y. Times.*

Government Telegraphy.

The government would, we suppose, have to buy the existing lines. These could not compete with the government, and would have to sell or go under. The bitterest opponents of Mr. Gould would hardly wish that all the other 2,590 stockholders of the Western Union should lose the value of their stock that he might be more effectually plundered. Mr. Edmunds will have to discuss that question.

The Western Union pays, we believe, something like $5,000,000 a year in salaries. The government will have to employ more persons than the company employs, for it will have longer lines and two or three government employés are usually required to do what would be one man's work in any private service. Salaries will have to be very much higher than under the existing companies, so as to prevent strikes. It will be interesting to see what Mr. Edmunds thinks the annual salary list would amount to. And unless the government gives extraordinary salaries, how can it insure itself against a strike? Perhaps Mr. Edmunds knows, but our esteemed contemporaries who like himself are in favor of the proposal do not know.

Mr. Edmunds, as a Republican, cannot be expected to look with disfavor upon the great increase in the office-holding class which will be required by the establishment of a government telegraph. That, however, is something for those who believe that there are too many office-holders already to seriously consider.

Finally, Mr. Edmunds ought to tell the Senate candidly whether he thinks that messages would be inviolable during a heated political campaign, if the party in power had a man in every telegraph office.

But whatever Mr. Edmunds may tell the Senate, it is well to remember that the scheme of a government telegraph is a great centralizing scheme. It is strange that any Democrats should favor it. It is essentially Republican.

The powers of the Federal government have been stretched far enough already, and too far. It is for those of us who are still faithful to the old and pure constitutional traditions to say, whenever it is proposed to give the government powers not expressly granted or reasonably implied and absolutely necessary, Hands off!—*N. Y. Sun.*

Patent Attorneys.

Many truths are embodied in the following item, which we find in the *Times* of this city: "The patent attorneys are, as a rule, a much better class of men than the pension claim agents, as the business involves great responsibilities and requires technical education of a high quality. There are many in the profession, however, who cast discredit on it, and in some respects the attorneys who practice before the Pension and Patent Offices are similar. Almost every nventor engages the services of a patent lawyer, and certainly every wise applicant does if his patent is complicated or valuable. The usual fee is $25 and from that up. The better firms charge $50 and upward. The most dangerous class of patent attorneys are to be found among those who advertise 'no patent, no pay.' One would think that these men, working as they do on a contingent fee, would be put upon their mettle and seek the interests of their clients. But it is found that very often they injure the inventor who employs them by getting the easiest and narrowest claim through that they can, in order to collect their fee. Many times inventors find their ideas sacrificed by these men in their haste to get any kind of a patent, without regard to the full intention of their client. Prosperous attorneys make large fortunes, but there are scores of hangers on who infest the office, seeking whom they may devour, and these people inventors should avoid. Better go at once to the office, and let the good-natured clerks and examiners patch up the crude and faulty application than employ one of these curbstone lawyers, for cheap labor in patent law is generally the most costly in the end. Competent and honest attorneys exist in plenty, and are glad to work for a reasonable fee."

New Railroad Danger Signal.

A trial was recently made on the Ninth avenue elevated railway, of this city, to test the practicability of the railway cab electric signals, the invention of Mr. T. A. B. Putnam. The method is simple and free from a complication of wires. A small dynamo-electric machine is placed in the cab of the locomotive, and the wires lead to the wheels and thence to the rails which constitute part of the circuit. The block system is used the road being divided into sections 1,000 feet long. The signal is given by the ringing of a bell on the cab, the main advantage claimed being that the engineer can hear of danger he might be unable to see. The inventor illustrated the various features of his system, signaling to the engineer any given distance that a switch or drawbridge is open, signaling to switches, bridges or depots the approach of a train signaling a train by track-walkers at points on the line, the track-walker being able to communicate directly with the engineer of an approaching train two miles away, signaling each train of two lines crossing on the same level, and opening and closing gates at crossings, all of which is accomplished by the movement of the train as it passes over the insulated rails. Each signal given is recorded by the alarm mechanism in the cab, and is a tell-tale of the events happening on a trip of the locomotive.

T. M. B. A. Amendments.

The following is a proposed amendment to the Constitution and By-Laws of the Telegraphers' Mutual Benefit Association:

NEW YORK, August 15, 1883.

To the Secretary Telegraphers' Mutual Benefit Association:

DEAR SIR: I propose that the following change be made in the Constitution and By-Laws:

Strike out Section IV. of the By-Laws and substitute therefor the following:

Section IV.—The officers and agents of the association, except the secretary, shall serve without compensation, but the secretary shall, by and with the advice and consent of the executive committee, appoint a properly qualified person to act as clerk for the Association, who shall receive such compensation for his services as may be authorized by the annual meeting. Or, in lieu of appointing such clerk, the secretary, with the approval of the executive committee, may act as clerk and receive the said compensation, provided that on accepting such compensation the secretary shall thereupon devote himself exclusively to the service of the association.

JAMES MERRIHEW AND 25 OTHERS.

The Effect of Lightning on Trees.

Our Geneva correspondent writes: "The frequency of thunder-storms in switzerland this summer (we have on an average two a week) has afforded Prof. Colladon, of Geneva, a great authority on electricity and meteorology ample opportunity of continuing his observations on the effect of lightning on trees and vegetation generally. He has ascertained that when lightning strikes a tree it leaves very few marks of its passage on the upper part and middle of the trunk, a peculiarity which he ascribes to the fact of those parts being more impregnated with sugar, a good conductor, than the lower part. As the electric fluid descends to the neighborhood of the heavier branches, where there is less saccharine matter, it tears open the bark and in many instances shivers the tree. It is no uncommon thing to find the lower part of a tree literally cut by the lightning, while the upper portion and the higher branches seem to have suffered hardly at all. Oaks, however, would appear to present an exception to this rule, for they are often found with tops quite blasted and the passage of the lightning lower down marked by a gouge-like furrow. These furrows sometimes go completely round the tree like a screw, the reason of which, says Prof. Colladon, is that the lightning follows the cells of which the bark is composed lengthwise, and in certain sorts of wood these cells are disposed spirally. A curious effect of lightning on vines is that it invariably strikes a great many vine stocks at the same time over a space for the most part circular, from 8 metres to 25 metres in diameter, and containing, therefore, several hundred vines. The plants most affected are those in the centre of the circle, and the number of burned and yellowed leaves diminishes in proportion to their distance from that point. In July two vineyards in this canton were struck by lightning, and the first idea of their proprietors, on seeing their shriveled vines, was that a still more dreaded foe, phylloxera, had been at work, but when the Professor was called in he speedily enlightened them as to the cause of the mischief, and, in proof of his diagnosis, pointed out that the ground in the centre of the circle was strewn with t orn leaves and freshly-broken twigs."—*London Times.*

Asleep on the Telegraph Wires.

People have been known to sleep on house-tops, in the branches of trees, and on rare occasions in a sleeping car, but probably the first case of any one selecting the top of a telegraph pole as a lodging place occurred Thursday night. Shortly after midnight Jack Donegan, one of the linemen employed by the telephone company, appeared, fully equipped in his working uniform, including climbers, at Wood Brothers ice house, at the foot of Holmes street, and asked the men in charge for the loan of a short piece of plank. Supposing that he wanted to use it in making some repairs of telephone lines, a large number of which pass directly in front of the ice house, they gave him the plank, but were unprepared for thes urprise which awaited them, for Donegan, taking the board under his arm, climbed to the top of a high pole near by, and laying the plank across the wires, cooly rolled up his coat for a pillow, and stretching himself on the plank, composed himself for a snooze, and was soon snoring as peacefully as a babe in its mother's arms. The employés of the ice house expected to see him fall every moment, but were afraid to make any attempt to wake him lest it should frighten him and precipitate his tumble. About 4 o'clock yesterday morning Officer Harrington came along, and being made acquainted with the situation, yelled at the high minded individual roosting at the top of the pole, and endeavored to persuade him to come down from his lofty perch. Donegan waked up in good order, but failed to recognize Harrington's authority to order him to come down. Finding persuasion of no avail, the officer, not to be outdone, and being something of a climber himself, "shinned" up the pole, and by the application of a little force, brought his man safely down to terra firma, and once more Donegan was taken to the station and a few hours afterward arraigned in the police court and fined $5 for drunkenness. Donegan says sleeping on the top of telegraph poles is one of his favorite pastimes, and he is unable to see any reason why he should be disturbed in his repose. —*Kansas City Journal,*

The National Telegraph Company.

The Cleveland *Herald* says that this company, recently incorporated, is the nucleus for a great telegraph system. The primary object of the new company is to unite the telegraph line of the West Shore Railroad, which runs from New York to Buffalo, with that of the Nickel Plate, which runs from Buffalo to Chicago. The Nickel Plate telegraph, having been built independently of the railroad, was not included in the sale of the railroad property to Mr. Vanderbilt. This new line of telegraph, connecting New York and Chicago, the greatest commercial cities of the United States, and passing through the most important intermediate cities, is a large nucleus of itself, but when the fact that the incorporators of the company are directors of other railroads beside the Nickel Plate and West Shore, aggregating several thousand miles, the East Tennessee, Richmond & Danville, Ontario & Western, Toledo, Cincinnati & St. Louis, Rochester & Pittsburgh and Michigan & Ohio roads all being under their control, it is very easy to see how a formidable telegraph line can be made with comparatively little trouble or expense. Right of way would cost nothing, etc. The point has been made that no successful telegraph line could be built without the aid and patronage of the railroads, which, like the telegraph, depend largely upon cities and towns for their support. The obstacle mentioned does not appear to be in front of the National Telegraph Company.

Taxing Telephone Exchanges.

During the latter part of last month the Wisconsin Telephone Company commenced an action in the Circuit Court to recover $300 from the city of Oshkosh. The complaint alleges that the plaintiff has fully complied with the State law by paying the necessary license fee, and claims to be exempt thereunder from paying any other tax whatsoever except taxes upon real estate that it may own. An ordinance passed by the Common Council of Oshkosh, June 5, 1882, is then set forth in full. By the provisions of this ordinance a tax of $300 a year is levied upon the plaintiff's exchange in that city, and the Mayor is authorized to cut down all the poles erected by the plaintiff in said city unless the amount is paid in ten days from the passage of the ordinance. It is further alleged that July 2, 1883, the Mayor of Oshkosh proceeded to cut down a large number of the poles of plaintiff's exchange in Oshkosh, and that in order to save the further destruction of its property the plaintiff paid the license of $300 under protest. The present action is brought to recover this amount.

Although the amount involved is insignificant, the precedent the case will establish makes it one of the utmost importance. The question at issue is: Can a municipality levy a license upon the telephone company after it has paid the license provided by the State law?

"Oh! Hello, Central!"

Under this caption the Pittsburgh *Telegraph* of August 20 prints the following: "Manager Metzger's greatness of heart was manifested in the excursion enjoyed Saturday evening by the Central District and Printing Telegraph Company. These with their invited friends, to the number of one hundred and twenty, boarded the excursion barge Alice shortly after 6 P. M., and she was headed for the slackwaters, to the enjoyable strains of Staley's band. Of these 120, there were 23 damsels whose business it is to answer yells for 'Central' and to muss up their bangs against the transmitter while attempting to answer fourteen different customers at once. These fair ones particularly enjoyed the soothing influences of brass band, moonlight, lovely scenery and lunch after the embarrassment of 'Hello, Central!' They rested their weary auriculars with the echoes that answered the band from the everlasting hills, and many of them wished that Metzger were younger and single-er. Pretty well toward Sunday A. M. the boat returned, the messenger boys expressed their feeling in 'three cheers for Metzger,' and the enjoyable affair was over, to linger long in the memories of those who enjoyed it."

Educating Electrical Engineers.

NEW YORK CITY.

To the Editor of the Electrical World:

SIR: I copy the following from my note book on Electricity, and I think it may be a good hint to some one desirous and able to do good to those anxious to increase their knowledge of electrical engineering:

"The recent advances in the applications of electricity to daily life have created a clear demand for an institution where electrical engineers can be taught the theory and practice of their profession. At present there is no such training school worthy of the name, and so long as the electric telegraph was the only field for electrical engineers, there was little need for one. Times have changed now, however, and the introduction of the telephone, the electric light and transmission of power by electricity, not to mention a thousand miscellaneous adaptations of the current, have rendered it necessary to have an efficient training college for electricians. The interests of the electric light have already suffered by the incompetency of the persons to whom they have been intrusted, and serious accidents to life and property have resulted from the ignorance of those in charge. Electricity, above all other physical forces, is a thing which ought not to be dealt with by the unskilled."

I may add that I know many young men, now employed by the electrical light companies, who are desirous of learning all they can about the subtle agent they have to deal with, and who do things because they see others do them, but do not know the why or wherefore. I think a class could easily be formed by the co-operation of the electric light companies to enable any of their employés to attend and learn about the profession.

RICHARD J. WARD.

THE TELEGRAPH.

OBITUARY NOTE.—Prof. Varley, who was electrician to the Electric International Telegraph Company, which laid the first cable across the Atlantic Ocean, is dead.

EXTENDING THE POSTAL LINES.—It is stated that the Postal Telegraph Company is building a line from Baltimore to Philadelphia, and that it has purchased a line from Washington to Baltimore.

SOUTH AMERICAN TELEGRAPH TOLLS.—A dispatch from Monte Video, dated Sept. 1, says: The following tariffs have been announced for telegrams over the Central Company's lines, via Galveston: Between Uruguay and the United States, $3 a word; between all Uruguay and Europe, $2.71 a word.

THE WILLIAMS-HATCH SUITS.—Rumors have prevailed in Wall street circles for several days that the above suit against the Western Union is to be compromised by Mr. Gould agreeing to purchase certain railway stock from Mr. Williams at a high figure. Mr. Williams, however, denies that there is to be a compromise, or had been any talk of one. The suit, he says, will go on.

THE TELEGRAPH CONSOLIDATION.—A New York dispatch says that the *Commercial Advertiser*, on the authority of Vice-President May, of the American Rapid, denies the report that the Bankers and Merchants', the Southern and the American Rapid telegraph companies were about to unite forces. It would appear that Vice-President May is not well informed. President Converse and his son, the treasurer of the American Rapid, both admit the substantial correctness of the statement, while they say that some errors in regard to the details of the scheme have been made.—*Boston Advertiser.*

A NEW TELEGRAPH COMPANY.—The Citizens' and Telegraphers' National Union Telegram and Cablegram Company has been incorporated under the laws of this State for the purpose of constructing and operating independent telegraph and cable lines in the United States and Canada and across the Atlantic. The corporators are E. J. O'Connor, chairman of the Executive Committee of the Brotherhood of Telegraphers; Charles E. Chute, Master Workman of the New England Assembly of the Brotherhood, and Thomas W. Greene, one of the secretaries of the New England Assembly. The capital is $5,000,000.

WHAT HE WAS WAITING FOR.—Referring to that part of Mr. Gould's evidence before the Senate Sub-Committee in which he stated that he had started the American Union to provide a place for General Eckert, the *Times* of this city says: Mr. Gould seems to have a circuitous kind of mind. When he wanted to provide a handsome salary for a dear friend of his the simplest way would have been just to pay over a salary to the desired amount to his dear friend. But Mr. Gould found it necessary to organize two rivals to the Western Union, and finally to make that company let him in and pay a fancy price for his stock before he could get his dear friend established to suit him.

TELEGRAPH BUILDERS PLEASED.—A despatch from Richmond, Va., dated the 6th says: Much satisfaction is expressed in business circles here at the consolidation of the Southern Telegraph Company with the Bankers and Merchants' Telegraph Company, since it improves the prospects that the indebtedness of the former company will now be liquidated. It is said that the men who have been building the lines have not been paid for four months; that the company owes other officers considerable sums, and that their line material has been attached for freight and other bills. The gang of men employed on the lines between Charleston and Columbia repeat the same story of the operations on that railroad. It is believed that the new organization will see that these liabilities are discharged.

BRITISH COLUMBIA COMPLAINS OF THE TELEGRAPHS.—A dispatch from Ottawa states that an amusing protest has been made by the Government of British Columbia to the Dominion Government against the unsatisfactory telegraphic facilities the former now enjoys. The only way of telegraphic communication between British Columbia and the Eastern Provinces at present is through United States territory. The protest is made on the ground that in the event of a rupture between England and the United States the first intimation of trouble would pass over the lines of a country with which Canada would be at war. Going west, uninterrupted telegraph communication has been established as far as Calgarry, 600 miles west of Winnipeg along the Canadian Pacific Railway, and east from the Pacific as far as Kamloops. The intervening link of some 300 miles will be completed as the work on the railway goes on. Not until then are the British Columbians likely to have their demands complied with.

ANOTHER SUIT AGAINST THE WESTERN UNION.—A suit was begun in Philadelphia on Saturday last for damages against the Western Union Telegraph Company for negligence during the late strike. Mrs. William Dunham, of Concord, Mich., received a letter from a relative in the East stating that her mother was not expected to live. Mrs. Dunham at once telegraphed her father, Mr. DeVinney, in Philadelphia, asking whether it would be advisable for her to come. Mr. DeVinney replied that her mother was not seriously ill. Mrs. Dunham did not get the mes-

sage, and started for Philadelphia, notwithstanding she was in a delicate condition of health. When she arrived, her mother was in fair health. Mrs. Dunham's condition, however, was very serious, being prostrated and in a very critical state. The telegram from her father was never delivered, and the only satisfaction they could obtain from Superintendent Zueblin was the statement that "the strikers must have stolen the telegram."

UNDERGROUND TUBES AND WIRES IN THIS CITY.—The pipes for the pneumatic tube service of the Western Union Telegraph Company are being laid between the building of the company, at Broadway and Dey street, and the new building at Fifth avenue and Twenty-third street. Four brass tubes, each 3 inches in diameter, will be put down. In the same trench will be laid two 5-inch iron pipes for holding telegraph wires to be used in local business. The company now has 75 miles of wire underground between the main building and the Stock and Cotton Exchanges and the North River cables. The pipes are laid four feet underground to be out of reach of the frost. The pneumatic tubes will be in operation early in the winter. Pneumatic tubes now run to the newspaper offices, the Stock and Cotton Exchanges, the Equitable Building, and the cable offices. The new Produce Building will be connected with the main office in the same way.

OPPOSED TO TELEGRAPH POLES.—All of the leading telegraph companies whose lines enter Washington, D. C., including the Western Union, the American Rapid, and the Baltimore & Ohio, have recently made applications to the District Commissioners for leave to erect new lines of poles or reset old lines in various parts of that city. These applications have all been denied upon the ground that the poles and wires disfigure the streets and interfere with growing trees. The request of the Western Union Company, which was referred to Captain Greene, was returned with the following indorsement: "Not recommended. In place of setting new and larger poles, this trunk line should be placed underground without delay." It is understood that Major Lydecker and Captain Greene now have under consideration a plan for an underground system of wires within the city limits, and that the District Telephone Company will shortly begin the work of laying a mile of wires underground for the purpose of experiment.

THE TELEGRAPH CONSOLIDATION.—Another move was recently made in the scheme to amalgamate the Bankers & Merchants', the Southern and the American Rapid telegraph companies. There was a meeting of the board of directors of the Southern, at which A. W. Dimock, the president; G. S. Mott, the superintendent; J. G. Case, the secretary, and G. Putnam Smith, a director of the Bankers and Merchants', were elected directors. The number of directors was increased from 9 to 11, and Townsend Cox, Jr., and H. S. Allen retired to make room for the new members. Mr. Case took the place of Mr. Cox as treasurer. The remainder of the board consists of James F. Cox, A. J. Baldwin, G. E. Mercer, C. E. Blumenthal, F. R. Scott, of Richmond, Va.; W. E. Cameron, Governor of Virginia, and J. B. Whitehead, of Norfolk, Va. The changes, with the co-operation of some of the directors who remain in the board, put the Bankers & Merchants' in control of the Southern. The plan to bring the Rapid under the same control as the other two companies is approaching consummation.

THE TELEPHONE.

"HELLO."—When Bell, the telephone man, dies he will have a "Hello" of glory encircling his head.

DR. A. E. DOLBEAR.—Michigan University has conferred the degree of Ph. D. upon Professor Amos Emerson Dolbear, of Tufts College, inventor of the Dolbear telephone system.

THE TELEPHONE IN CHURCH.—A Western journal opposes the use of the telephone for connecting houses with churches, and clinches its argument with the question: "How's your wife to see bonnets by telephone?"

TELEPHONES IN BOSTON AND LOWELL.—Boston, with a population of 350,000, has 1,200 telephone subscribers, while Lowell, with a population of 60,000, 20,000 being mill operatives, has 1,000 telephone subscribers. The "Hub," at this rate, should have 4,000 subscribers. There's "something wanting" in Boston.—*Lowell Courier.*

TELEPHONES FOR THE SCHOOLS.—Superintendent MacAllister has suggested to the Philadelphia Board of Education the placing of telephones in the grammar schools. The cost of the improvement is estimated at $3,000. The "phones" will connect with the Board headquarters on Filbert street, below Eighth. The sub-committee on office is now considering the question.

SUIT AGAINST THE BELL TELEPHONE IN AUSTRIA.—Prof. Bell, the inventor of the Bell telephone, has become involved as plaintiff in some heavy litigation concerning alleged infringements of his patent in Prague, Trieste and other places in Austria. The defendants are some of the most prominent capitalists of the empire, and the leading lawyers of the country have been retained on both sides.

EXTENDING THE LOWELL TELEPHONE FACILITIES.—Referring to the abandonment of the proposed consolidation of the New England telephone companies, it is announced that the Lowell syndicate comtemplates redistricting the Suburban Company and building several important territorial lines in New Hampshire, Vermont and Massachusetts.

THE TELEPHONE IN NASHVILLE, TENN.—We have received a list of the subscribers of the Cumberland Telephone and Telegraph Company, dated August 23, 1883, and also a list dated Sept. 25, 1882. One year ago the list only amounted to 177, and the exchange was connected with only six of the neighboring cities and towns. The last list shows an increase to over 700 subscribers and connection is now made with 24 towns from 7 to 75 miles away. For communications of five minutes or less, the rates are from 25 to 35 cents, and a messenger fee of five cents is charged when a party is sent for at a distance of a quarter of a mile or less.

THE TELEPHONE IN NORTHWESTERN PENNSYLVANIA.—The Erie *Gazette* of the 26th ult. says: Superintendent G. W. Baxter, of the American District Telephone Company, has returned from Edinboro and Cambridge after completing the purchase of the line between McKean and Edinboro and arranging for the extension of the line to Cambridge. He was offered all the facilities he desired by the authorities of both boroughs for the completion of his plans. This stroke of enterprise will put Erie in connection by telephone with Cambridge, Meadville, Oil City, Bradford, Titusville, Conneautville, Evansburg, Spring, Linesville and a number of small places in Crawford County.

THE DECISIONS IN ENGLAND REGARDING TELEPHONE INVENTORS.—Regarding recent telephone decisions the London *Echo* has the following: It is an open secret that the adverse decisions of the English courts in the matter of the Bell telephone patents came upon the scientific world much as a surprise, for, although it is tolerably well understood that law is not always common sense, it certainly was not expected that the courts would decree what is a virtual monopoly in favor of a device which is simply a development of ideas too old to be the subject of a patent. Any special method of carrying the idea into the domain of practical work was a legitimate subject for a patent, but the courts have granted a monopoly of the principle, and invention is for the time muzzled. Philip Reiss was the real inventor of the telephone, if we must fix upon a period and a man; but, like most other inventors, he derived much knowledge from the labor of those who went before him, and could claim only his special methods of working.

THE ELECTRIC LIGHT.

ELECTRIC LIGHT FOR WORCESTER, MASS.—Arrangements have been made with the American Electric and Illuminating Company, of Boston, for the immediate construction of a central lighting station having a capacity of 200 lights.

LIGHTHOUSE TO USE ELECTRICITY.—The government lighthouse at Hallet's Point, L. I., is being rapidly pushed forward. It is to be an electric light of 20,000 candle power, and 150 feet high, in order that its rays may not dazzle the eyes of pilots passing under it.

ELECTRIC LIGHT COMPANIES CONSOLIDATE.—The plant and good will of the Lowell (Mass.) Electric Light Company has been transferred to the Middlesex Electric Light Company. The Weston dynamo-electric machines will be replaced by those of the Thomson-Houston pattern as soon as they can be obtained from the factory. The lamps will also be changed.

TROUBLE IN LANCASTER, PA.—The Maxim Electric Light Company, of Philadelphia, which, as we noted some weeks ago, was awarded the contract for lighting the city of Lancaster, is in trouble with property-owners in that place, who object to the erection of the company's poles in front of their houses. One of the indignant citizens inaugurated the pole-chopping method last week, and as others are prepared to follow, the usual litigation may be expected.

THE ELECTRIC LIGHT SAFER THAN KEROSENE.—At the session of the Fire Underwriters' Association of the Northwest, held in Chicago on the 30th ult., Prof. A. E. Dolbear, of Tufts College, Medford, Mass., read a paper on "Electricity," and in answer to queries as to the danger from electric lighting, said that the danger from various systems was very great, unless proper precautions were taken; but declared that the regulations already enforced by the insurance companies made lighting by electricity altogether safer than by kerosene.

LIGHTING A LARGE MILL BY STORAGE BATTERIES.—On Monday of last week an important exhibition of the Brush storage battery system of lighting was given at Willimantic, Conn. Mr. W. E. Barrows, treasurer of the Willimantic Linen Company's mills, telegraphs as follows to the Brush Electric Company, Cleveland: "Inauguration of Brush storage batteries last evening a brilliant success. Three hundred and sixty-five lights burned for four hours, illuminating No. 2 mill, the store, library, reading-room and offices. Over two thousand people present. Everybody delighted."

A SEVERE SHOCK.—A Lowell, Mass., paper reports that the managing electrician of the electric light company in that city recently narrowly escaped death. He was inspecting the dynamos, which were in full motion, and was regulating the screw of the brushes, when he slipped on the oily floor. In falling he kept hold of the screw with his right hand and with his left instinctively clutched the dynamo opposite to save himself. At once the full force of the 25 horse-power current passed through his body. He fell apparently lifeless, but was restored by hard rubbing. He suffers no pain, but is filled with an indescribable sense of weakness. His hands are swollen and burnt.

SPARROWS AND ELECTRIC WIRES.—The *Iowa State Register* tells the following yarn: "Dead birds are frequently discovered under the electric light wires in the morning by town boys of Des Moines, who have learned to look for them. The current kills all which light upon the wires while they are hot or in operation, but does not harm them when cold, or during the day, and this deceives the feathery tribe. Quite a flock of sparrows met their doom on the street wires just at twilight. They could not leave the wires after lighting on them and dropped off dead one by one until the several urchins present had their hats full." To say nothing of the facts that electric light wires are usually insulated, and that, in any case, in order to receive a shock from them it would be necessary to form a connection between two wires, an explanation seems to be due from the *State Register* as to why the current, which holds the living birds so firmly, drops the dead ones.

MISCELLANEOUS NOTES.

UNDERGROUND CABLE.—Marseilles and Paris are now connected, at a cost of $8,000,000, with an underground cable, which is laid in a cast-iron pipe six feet below the surface, and is so arranged that it can be from time to time inspected.

PATENT OFFICE RECEIPTS.—The receipts on account of patents during the month of August, 1883, were $92,464, against $87,040, during the same month of last year. The receipts from January to August, 1883, were $786,659, and during the corresponding period of 1882, $685,444.

PHOTOGRAPHING LIGHTNING.—Dr. Haensel, a savant of Reichenberg, Germany, has succeeded, after many experiments, in photographing several flashes of lightning. The photographs took in part of the landscape, and made it possible to estimate with accuracy the locality where the lightning struck. It also proved possible to compute the length of the course traversed by the electric current. These experiments are to be continued, with the aid of stereoscopy. They have awakened much interest.

A PLEA FOR PURE SCIENCE.—At a meeting of the American Association for the Advancement of Science, lately held in Minneapolis, Professor H. A. Rowland, of Baltimore, addressed the section of Physics on a "Plea for Pure Science," declaring that the pursuit of science is a very different thing from seeking to discover labor-saving applications of it. He said the study of the telephone and electric light is no more fit to be termed science than cookery is to be called chemistry. Our universities must be fully endowed with laboratories and abundant apparatus. The least that the Government can do in their aid is to omit the tariff on imported books used in study.

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Thursday of last week and Thursday of this week as follows:

	Aug. 30.	Sept. 6.
American Cable	60¾	64¾
Western Union Telegraph	76¾	81
Bankers' and Merchants' Tel	140	129
Mutual Union Telegraph	15½	17¼
American District Telegraph	15	30
Bay State Telephone	100	99
Bell Telephone	232	....
Currier Telephone Bell Co	....	....
Granite State Telephone	....	....
Mexican Telephone Co	2¾	2¼
National Bell Telephone of Maine	70	70
Suburban Telephone Co	107½	105
Tropical Telephone	2	....
New York and Pennsylvania	91	92
Boston & Northern Telephone	125	125
Union Telegraph and Telephone	....	....
Erie Telephone	59	60
United States Electric Light	....	....
Edison Electric Light	....	....
People's Telephone	....	....
New York and New Jersey	95	96

STILL ANOTHER UNDERGROUND COMPANY.—The Electric Underground Company of Baltimore City has been incorporated by William H. Hoopes, Charles H. Latrobe, John M. Denison, Walter S. Wilkinson, Walter B. Brooks, Enoch Pratt, John S. Berry, Wm. F. Burns, Francis H. Hambleton and E. C. Eichelberger, all residents of Baltimore City except Hoopes and Berry, who are of the county. The directors are Messrs. Hoopes, Latrobe, Denison, Wilkinson, Brooks, Berry and Hambleton. The business of the corporation will be the building, constructing and operating telegraph, electric lighting and telephonic wires by a system of underground wires, and it is also formed for the purpose of constructing and operating a system of underground wires for telegraphic, electric lighting, telephonic or other purposes in the city of Baltimore and the counties of the State of Maryland and elsewhere. The capital stock is $1,000,000, divided into 10,000 shares of the par value of $100 each.

PATENTS OF THE STOCK-PRINTING MACHINES.—Notices have been served by the Gold and Stock Telegraph Com-

pany, in this city, on brokers using the stock-printing machines of the Commercial Telegram Company. It is claimed that they were infringements on patents held by the former company. Persons using the instruments were liable, as well as the company, and suits would be brought against them if their use was not discontinued. The Commercial does not have the privilege of the Stock Exchange floor. Only about 20 of its instruments have been put in, and it has not fairly begun operations. The Gold and Stock pays $18,000 a year for the Stock Exchange privilege.

RULINGS IN PATENT CASES.—In a recent decision in a patent case, Commissioner Marble made the following rulings:

"Amendments of the specification offered after the decision of an appellant tribunal will be forwarded at once to the primary examiner, whose duty it is to determine in the premises all questions relating to the admissibility and merits of such amendments.

"Regarding two years from the date of the last official action as the natural life of the application, it is clear that an applicant is entitled at any time within that period to take such action in his case, whether by appeal or amendment, as shall be necessary to protect his right to a patent, subject, however, to such regulations not inconsistent with this fundamental right as the Commissioner and Secretary shall establish for the conduct of business in the office.

"By the omission from rule No. 67 of the clause in old rule No. 31 relating to the recommendation of amendments, the whole distinction of special amendments *es nomine* was abolished, and the primary examiner by implication is made the judge as well of the admissibility as of the merits of all amendments."

DEPARTMENT OF INQUIRIES.

42. ADHESION OF BLUE VITRIOL TO BATTERY JARS.

Can you tell me how to keep the blue vitriol in Calland batteries from getting hard and fast to the glass jars? We have over two hundred cells in our main battery, and we have considerable trouble in trying to get the vitriol out. The jars are often broken. J. H. S.

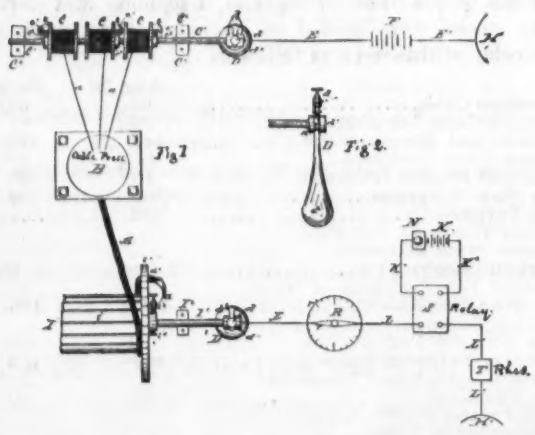
ELMIRA, N. Y.

It is recommended by many practical electricians to cover the surface of the glass where the adhesion is likely to occur with some oily or unctuous substance. In some cases a rag which has been dipped in some thick oil, like black oil or castor oil, is passed lightly over the surface of the glass jar both inside and outside. This makes a repellant surface that not only prevents the adhesion of the crystals, but prevents the formation of climbing salts of both blue and white vitriol. Ordinary spirits of turpentine will dissolve a small proportion of beeswax making a solution which may be used for the purpose. Paraffine wax dissolved in benzine is also frequently used for the purpose.

ELECTRICAL PATENTS ISSUED

And Dated August 28, 1883.

Art of testing electric cables; William J. McElroy, Pittsburgh, Pa..... 284,138



The invention relates to the art of testing lead covered electric cables during the operation of applying the lead to the wires. In general terms it consists in passing a continuously sustained current of electricity through the insulated wires as the lead is applied, and also through a signaling device, the lead-applying mechanism being between the electric current generator and the signal device.

Fig. 1 is a general plan of the combinations of circuits and mechanism employed, and Fig. 2 is an elevation of the device employed in making circuit connection with the reel shaft.

In the manufacture of lead-covered electric cables by means of a lead press, it is customary to apply the lead to the wires at a temperature of about 300 degrees Fahrenheit, which is high enough to melt the insulating compound with which the wires are coated. This element of heat sometimes causes defects in the insulation of the wires, which it is desirable to detect and remove at once. To do this a battery and galvanometer are usually put in the circuit, having terminals in the insulated wires and in the lead covering. On the occurrence of a fault the battery circuit would be completed and the needle of the galvanometer deflected. This required constant watchfulness on the part of the attendant. It has been tried to give an audible signal to the attendant by the use of an ordinary relay and local bell-ringing circuit, the relay being in the normally-open circuit. But it was found that soon after the cable began to come from the press that the relay would close the bell circuit, apparently indicating a fault; but on stopping the press the relay would react and the bell circuit be opened. This current varies directly with the temperature of the lead, and on account of this direct relationship, the inventor is induced to call it a "thermal" current.

In the drawings a lead press is represented at *B*, which may be of any suitable construction, adapted to receive the desired number of insulated wires *a* and apply the lead covering under pressure, delivering the cable *A* complete and ready for use. The reels *C* upon which the wires *a* are wound, are mounted on a metallic shaft C^1 which is supported on bearings C^2 made of a non-conducting material. The inner ends of the wires pass through the reels and are electrically connected to the shaft. Circuit is continued from the shaft by the line *E* which is secured to the building post *d* placed on the removable weighted hook *D*. The line connects with one pole of the battery *F*, the line from the other pole being grounded. As the finished cable passes from the press it is wound on the wooden reel *I* secured to the metal shaft I^1. The end of the cable is passed through the head of the reel and the denuded ends of the wires secured to the binding post i^2, on the collar i^3. The line *L* is connected to the shaft by a weighted hook, made and operated like the one on the other line. The line *L* is then carried through a galvanometer *R* through the coils of a plain relay S^1, and through a rheostat *T* to the ground. To the rear parts of the relay a local battery and circuit are connected with an electric bell.

During the operation of making the cable a continuous battery current is maintained through the entire length of cable wires, and through the galvanometer and relays on one side, the battery being on the other side of the press. This sustained current will hold the armature of the relay forward. If a fault occurs in the insulation of the cable wires, the battery current will be short circuited through the same and through the press, which is ground-connected, thereby closing the bell current and giving the alarm. Ordinarily the fault which will short circuit the battery current will have a like effect upon the thermal current excited in the cable. The galvanometer, although not essential in carrying out the invention, is useful, in connection with the rheostat, to indicate degrees of temperature in the cable. This is done by adjusting the resistance of the line so that the needle will stand at a certain point, and, as the current is constant, any deviation will be due to the thermal current.

Art of testing lead covered cables; Henry Van Hoevenbergh, Elizabeth, N. J..... 284,094
Automatic cut-out for electric lights; Alex. Bernstein, Boston, Mass..... 283,748
Circuit for telephone call boxes; Charles E. Scribner, Chicago, Ill..... 283,927
Combined cut-out and ground switch for telegraph and telephone lines; Charles H. Lothrop, Lyons, Ia..... 284,031
Duplex and quadruplex telegraph; George W. Gardanier, New York, N. Y..... 283,995
Dynamo-electric machine; Karl Zipernowsky and Maximilian Déri, Buda-Pesth, Austria-Hungary..... 284,110
Electric cable; Patrick B. Delany, New York, N. Y.... 283,763
Electrical conductor; Patrick B. Delany, New York, N. Y..... 283,764
Electric locomotive; Leo Daft, Greenville, N. J..... 283,759

Figure 1.

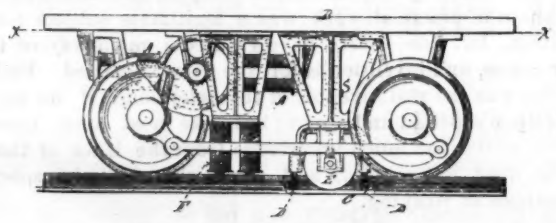
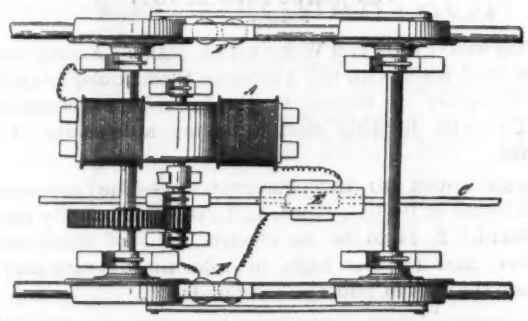


Figure 2.



The invention relates especially to improvements in the mechanism for driving and stopping locomotives. The electricity may be conveyed to the engine by a conductor placed between the rails; the number of conductors can be increased so that several engines may be run upon the same section of road. A wheel is carried by a frame moving laterally in a dovetailed slide. The conductor is cleaned by brushes placed in front of the wheel. Between the driving wheels are arranged traction magnets, preferably over both rails. These magnets are as near the rail as practicable and should be carried by some part of the engine not supported by springs. As soon as a current is passed through these magnets, the driving wheels will be drawn tightly against the track, thereby increasing the traction of the locomotive to any desired extent. An electric brake is used to stop the engine. A coil surrounds the axle of the wheels, which are magnetically connected with it. A current passing through the coil will magnetize the wheels, thereby increasing their tractive power upon the rails. An iron brake is provided, which is withdrawn from contact with the surface of the wheels by a spring. When the wheels are magnetized the shoes will be brought in contact with the surface of the wheels.

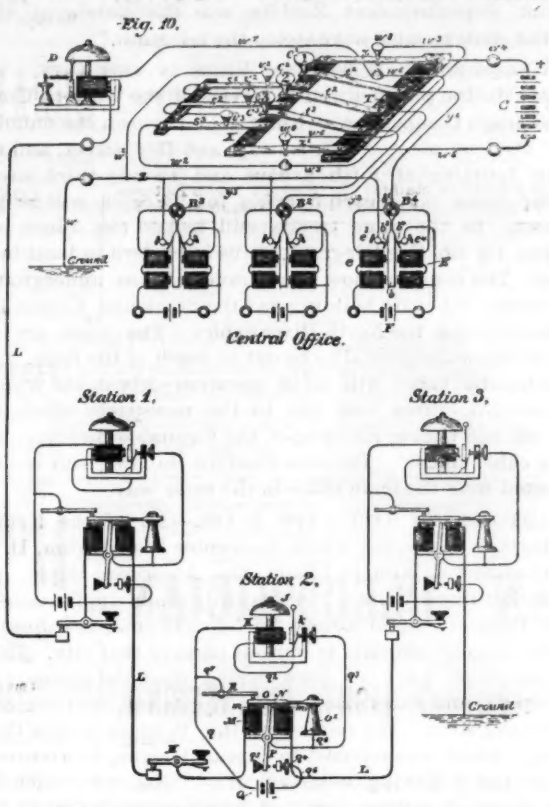
Electric locomotive; Leo Daft, Greenville, N. J..... 283,761
Electric signal for railway stations; Aaron D. Blodgett, Robert M. Read, Cambridge, and Jacob P. Tirrell, Boston, Mass..... 284,114
Insulating material and preparation of the same; Richard S. Waring, Philadelphia, Pa..... 284,098
Joint connection in lead-covered electric cables; Richard S. Waring, Philadelphia, Pa..... 284,099
Lightning conductor; Henry W. Spang, Reading, Pa.. 284,082
Rail for electric railways; Leo Daft, Greenville, N, J. 283,760
Signaling apparatus for telephone and telegraph lines; Elisha Gray, Chicago, Ill., and Frank L. Pope, Elizabeth, N, J..... 284,003

The invention relates to an improved method of and apparatus for signaling upon telegraph or telephone lines in cases where it is desirable to place a number of different stations upon the same circuit. The object is to enable the operator at the central station to signal any one of the sub-stations, and to enable either of the sub-stations to signal the central, without actuating the apparatus in any other station.

Upon a board in the central station are three transmitters, together with three keys by which they are brought into action. Signals from the stations are received upon an electro-magnet call bell. Each transmitter is furnished with a steel reed, each being tuned to a certain musical pitch. Each reed is maintained in continuous vibration at its normal rate by the alternate attraction of two electro-magnets which face opposite sides of the reed and act upon it as a common armature. These electro-magnets are alternately brought into action by means of a contact spring mounted on the reed. Reeds tuned to the same pitch are in the sub-stations. Each transmitter is placed in a separate branch of the main circuit, which extends to the sub-stations, and the several branches are closed by their respective keys when it is desired to transmit their vibrations over the line.

A constant current is maintained upon the main line *L* by means of a main battery *G* at the central office. When the main line is in its normal position of rest and ready for use, it is traversed by a constant current from the negative pole of the main battery at the central station. This current passes through the keys *H* and the electro-magnets *M* at each sub-station, and the polarity of the magnetism generated thereby deflects the polarized armature *P* at each sub-station, keeping it in contact with the insulated stop q^3. If the operator in the sub-station de-

Fig. 10.



sires to signal the central station, he presses his key, thereby breaking the main circuit. This causes the bell *D* to be struck, but will not affect any other station. If the operator at the central station desires to signal station 2, for instance, he depresses the key marked C^2 when a connection is established between the spring t^2 and the spring s^2, and at the same time the contact previously existing between the spring s^2 and the stop v^2 is broken. The same operation depresses the bar *X*, and the springs *x* x^1 are respectively removed from contact with the terminals w^5 and w^9 of the wires w^3 and w^6 and brought into contact with the wires w^7 and w^2. This operation switches the main line circuit through the appropriate vibrating transmitter-reed B^2, and as also reverses the polarity of the battery *G* with respect to the line. The change of the polarity of the main-line current causes the polarized armature *P* at every one of the sub-stations to be deflected from its normal position and come in contact with the stop q^4, thus closing the circuit of the local battery. The closing of the local circuit produces no effect upon the electro-magnet of the bell *J*, as the latter is shunted by the contact between the reed *O* and the vibrating bar *R* which rests upon it. But in station 2 the reed *O* being adjusted to vibrate in response to the reed of the transmitter B^2, will be set in vibration, and this vibration will cause the loosely-pivoted bar *R* to hop up and down, interrupt the shunt circuit, and allow the magnet *K* to become active. The bells at the other stations will remain quiet.

System of electrical distribution; Thomas A. Edison, Menlo Park, N. J.....283,982, 283,984, 283,985 and 283,986
Telephone exchange; Irwin M. O'Donel, Pittsburgh, Pa. 283,806
Telephone and signal circuit; Ernest P. Warner, Chicago, Ill..... 284,102
Telephonic apparatus; Walter A. Belcher, Lowell, Mass. 283,747
Testing box for underground electric cables; William J. McElroy, Pittsburgh, Pa..... 284,139
Truck for paying off electric cable; Richard S. Waring, Pittsburgh, Pa..... 284,100
Underground conduit for electric wires; Elbanan Omensetter, Philadelphia, Pa..... 283,807

BUSINESS NOTICES.

Mr. J. S. Lawrence, dealer in watches, diamonds and jewelry at No. 3½ Maiden lane, this city, makes a specialty of demagnetizing watches, a subject upon which we recently published an article that has attracted much attention. It is delicate work, and requires the exercise of much care and skill. We are personally acquainted with Mr. Lawrence, and have had occasion to judge the good work he has accomplished in this line.

MR. A. A. COLBY has just completed a contract with the West Shore R. R. Co. for 16,500 cedar telegraph poles. The poles have all been delivered and are pronounced very satisfactory by the company. Mr. Colby makes a specialty of supplying cedar poles of the best quality, promptly and at the lowest ruling prices. Those using quantities of poles will do well to communicate with Mr. Colby and get his prices. His address is Post-Office Box 297, Buffalo, N. Y.

The Fetter Drive Screw Company, of 104 John street, this city, has manufactured its celebrated drive screws for several years, and has acquired a reputation second to none. The peculiar form of the thread and point (see illustrations in advertisement on last page of this issue) presents no obstacle to easy driving, while the barb-like form renders slipping or loosening impossible. The hold thus obtained on the wood is claimed to be 33 per cent. more than in the lag screw. More than this, the form insures a firm hold in any kind of wood, and effectually bars the entrance of moisture. They are made of the best iron, and of all sizes from one-half inch diameter up, and any length. They are especially adapted to telegraph work, one form having an end projection being widely used for pole steps. The fact that they can be driven without boring constitutes a great advantage. The company has just obtained a decree in the United States Court on their patent. In actual tests this drive screw sustained 30 more than any other while requiring much less power to drive it.

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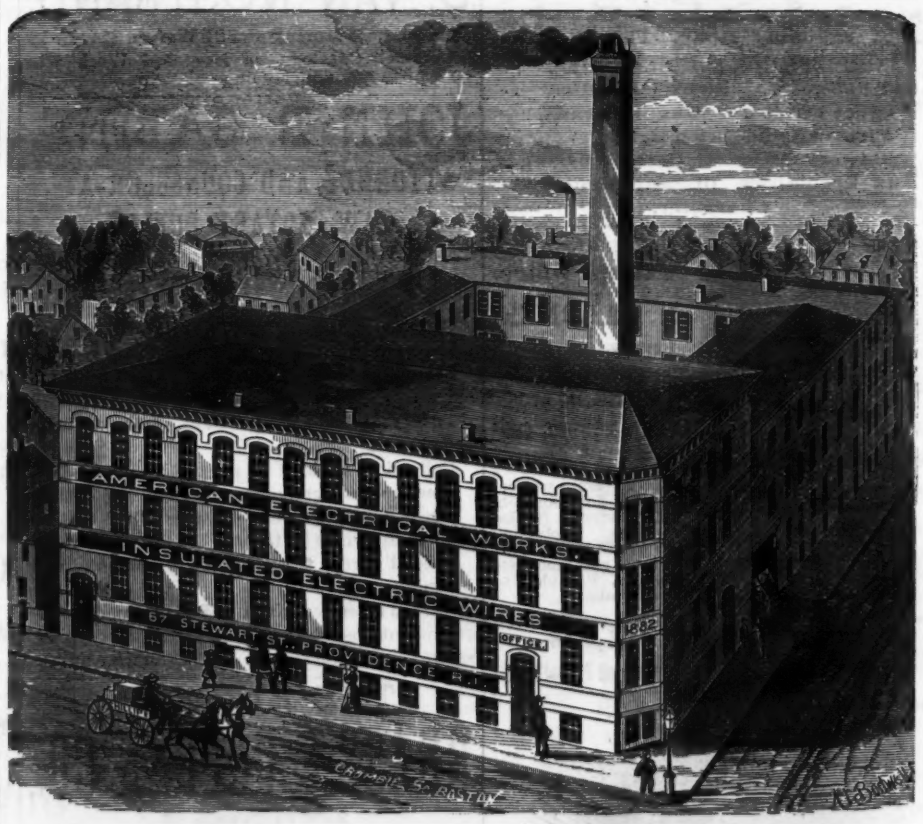

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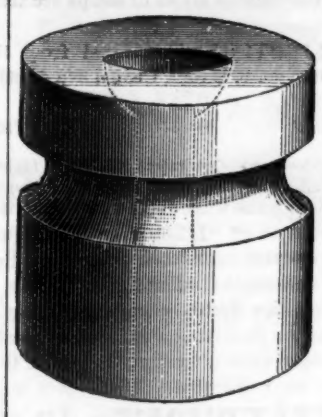

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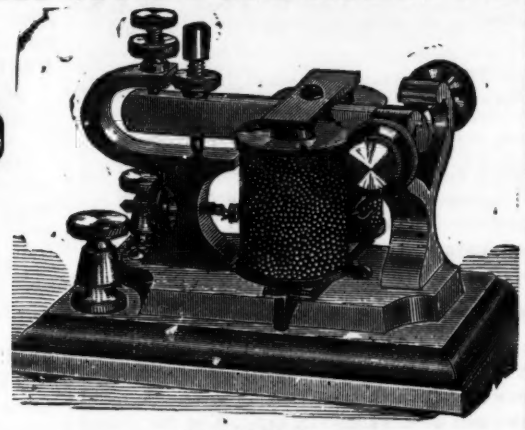

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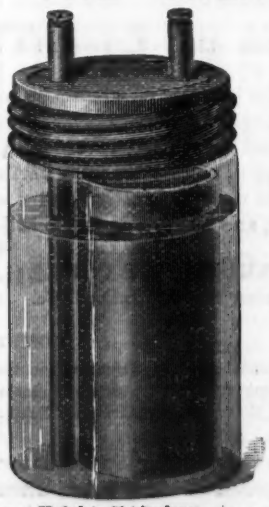

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THE SPEAKING TELEPHONE, ELECTRIC LIGHT, AND OTHER RECENT ELECTRICAL INVENTIONS. By GEORGE B. PRESCOTT. 8vo, cloth, 319 illustrations and 1 plate. New York, 1879. $4.00.

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USEFUL INFORMATION ON ELECTRIC LIGHTING. By KILLINGWORTH HEDGES, M.S.T.E. Fourth Edition, Revised and Enlarged. Crown 8vo, cloth, 20 plates. London, 1883. $1.75.

CONTENTS.

Production of Electricity—Voltaic Arc—Division of the Electric Light—Machines or Generators—Power required and Motors—Application of the Electric Light—Choice of a System—Setting to Work—Cost of Working—Measurement of Light and Current—Storage of Electricity and Transmission of Power—Electrical Measurement of Work—Useful Memoranda.

The first edition of this work met with so great a success as to encourage the issue of enlarged second and third editions, which have in turn been exhausted. A fourth edition, still further enlarged, has just been issued.

ELECTRIC LIGHTING BY INCANDESCENCE, AND ITS APPLICATION TO INTERIOR ILLUMINATION. A Practical Treatise. By WILLIAM E. SAWYER. 8vo, cloth, 96 illustrations. New York, 1881. $2.50.

CONTENTS.

Introduction—Generators of Electricity—Generators of the Gramme Type—Generators of the new Siemens Type—Incandescent Lamps—Carbons for Incandescent Lighting—New Forms of Lamps—Preservation of Incandescent Carbons—Division of Current and Light—Regulators and Switches—General Distribution—Commercial Aspects.

This book is an indispensable addition to the libraries of all who desire to keep up to the age in the novelty of electric lighting. Its author neglects the arc light altogether, and gives his readers a graphic account of the generators employed in the production of the necessary currents; of those lamps which utilize the currents when generated; of the most advantageous circuit arrangements and apparatus, and of the best materials to use in lighting by incandescence. A historical sketch shows that the idea of electric lighting by incandescence is as old almost as telegraphy itself. The book is handsomely printed and copiously illustrated.

INCANDESCENT ELECTRIC LIGHTS, WITH PARTICULAR REFERENCE TO THE EDISON LAMPS AT THE PARIS EXHIBITION. To which is added The Economy of the Electric Light by Incandescence, by JOHN W. HOWELL; and On the Steadiness of the Electric Current, by C. W. SIEMENS. Illustrated. 18mo, boards. New York, 1882. 50c.

There is no book that contains more valuable information in the same space than this On the question of incandescent lights it must be considered the best authority at present accessible. The tables and data given help very much in analyzing facts and making comparisons. The article by Mr. C. W. SIEMENS is especially valuable and interesting. It refers to a new method of exciting the field of dynamo-electric machines, which enables the current to maintain itself constant in the external circuit, no matter how great and rapid the variations of resistance may be. This method has come into use as a most valuable adjunct in the dynamos intended for incandescent lamps, where it enables any of the lamps to be put on and off at will without affecting the rest. For this reason this article is of great interest to every person interested in electric lighting.

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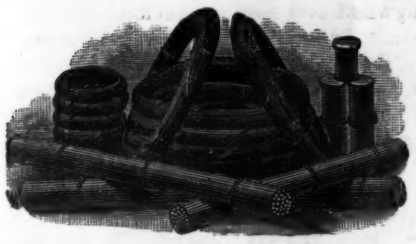

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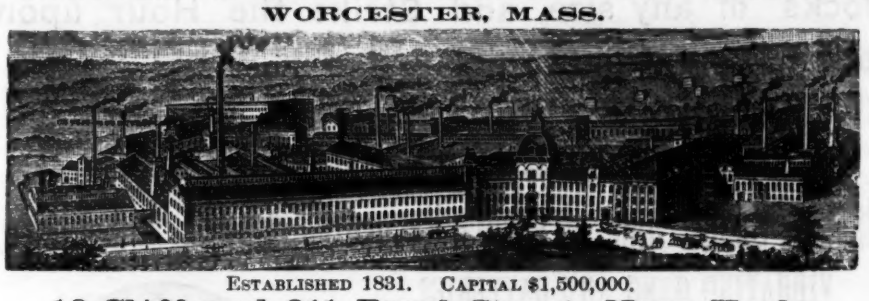

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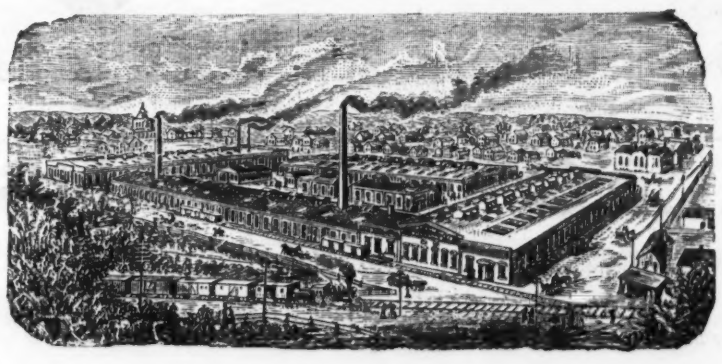

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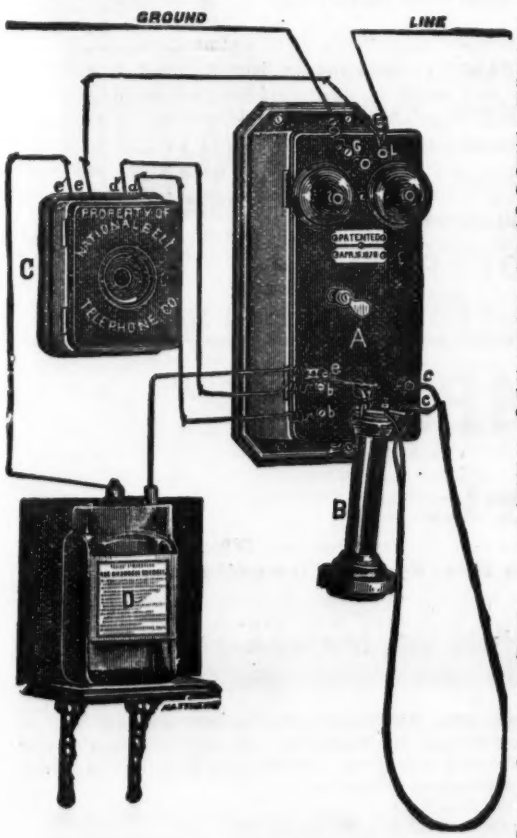

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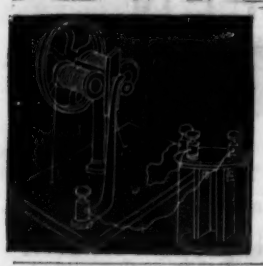

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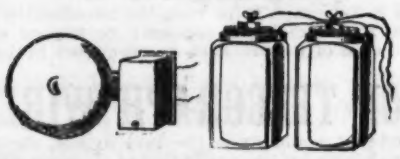

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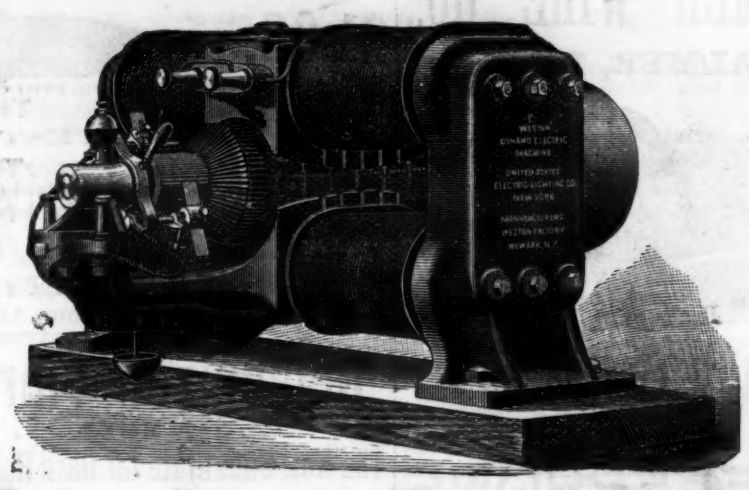

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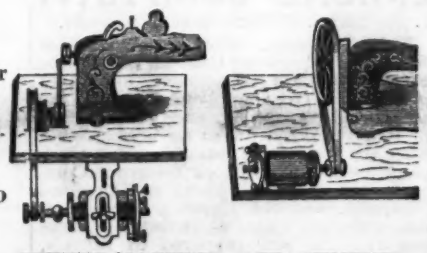

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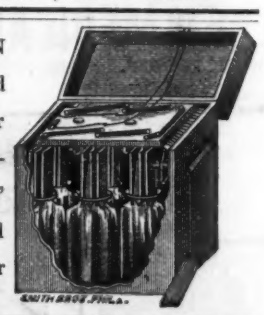

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